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RAILROAD GAZETTE

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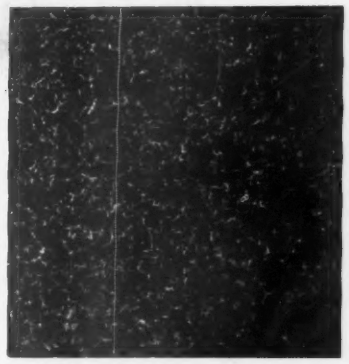
Rail Rolling at Lower Temperatures During 1901.

BY S. S. MARTIN.*

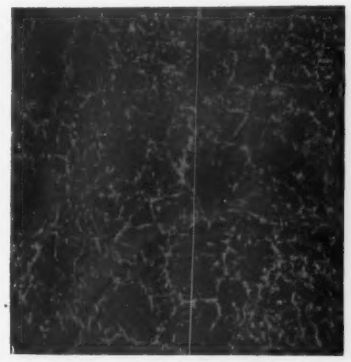
[The article which follows we reprint from the *Iron Age*, to which journal we are indebted for the etchings also.]

For years it has been known that light rails have a very much more nongranular structure than the heavy sections, which is caused by their being finished at a lower temperature. This structure means to the railroad people a better wearing rail. The latter have never developed the reason for it. To people asking the question, "Why did our rails rolled years back wear better?" we can easily answer that since the rails were lighter and since the methods were not improved for great tonnages, a structure was obtained which was nearer to the nongranular. It has only been in the last year that the subject has taken a practical turn in the direction of rolling the heavier sections (say 70 lbs. and up) nearer the temperature of the lighter rails. When the railroads made their rails heavier the manufacturers did not meet promptly the necessity of rolling their heavy rails at a lower temperature. Now the manufacturers find themselves pushed to do this, with the result that some of the mills reheating their blooms find that they must adopt some means of cooling the bar somewhere about the rail rolls, so as to roll at a very much lower temperature. To fully appreciate what low temperatures for rolling may really mean, I will briefly speak of rolling temperatures.

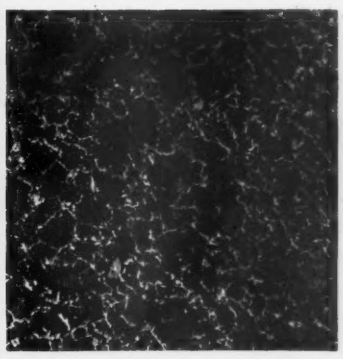
When steel cools from the rolling or finishing temperature there are certain points at which for an instant there is a retardation in the falling of the temperature, and sometimes a perceptible increase of heat. Soft steel, say under 0.20 per cent. carbon, has three of these points, while rail steel of 0.50 per cent. carbon has only one. These points are called the "points of recalescence," or, commonly, the "critical points." The structure of steel does not change below this point to any noticeable extent. Steel with 0.20 per cent. carbon or under, has three of these points, at 650, 740 and 860 deg. C., while rail steel of, say 0.45 to 0.55 per cent. carbon has only one critical point, which lies (according to different writers) between 700 and 725 deg. C. The structure of the rail depends for the size of its granules on the rate of cooling to the critical point and the higher the temperature above the critical point the larger will be the grains. Since no change of structure can result from finishing below the critical point, we naturally decide that a rail must be rolled as near the critical point as possible to get the best structure, or in the case of rail steel between 700 and 725 deg. C. If the piece of steel in rolling is delayed at any point before finishing it will help the structure directly in proportion to the amount of reduction in the remaining passes, because while the bar is being held (the temperature when starting to hold being about 950 to 1,000 deg. C.) the structure is crystallizing, and the higher the temperature the larger the granules to the critical point. For this reason the amount of reduction greatly influences the granular structure, and it should be considerable in order to move the grains to any depth in the bar. The result generally obtained from a number of micro-photographs of this class of finished rails is that the steel is non-granular just as far as the reduction in the last pass thoroughly moves the mass, which for a 5 per cent. reduction will be from ⅛ to ¼ in.; the rest of the distance to the center of the head becomes abruptly more granular from the ⅛ to ¼ in. until the center of the head, which shows the largest granules.



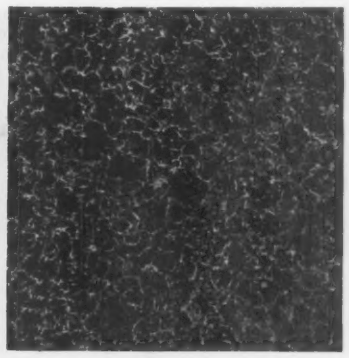
No. 169.—Edge of Head, 1-8 in. from Surface, 85-lb. Penna. Section. Rolled from Reheated Bloom.



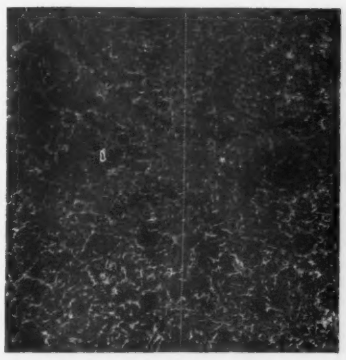
No. 169.—Center of Head, 85-lb. Penna. Section. Rolled from Reheated Bloom.



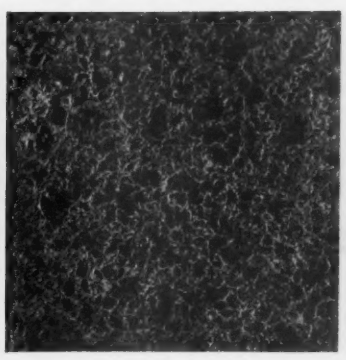
No. 201.—Center of Head, 75-lb. Rail. First Half of Ingot. Rolled as Hot as Possible. Held at Final Pass 1 3-4 Minutes.



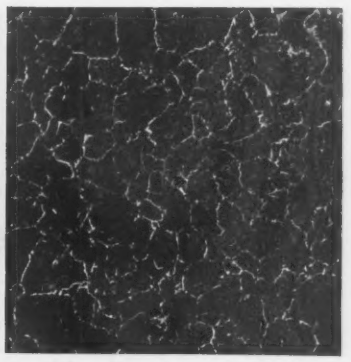
No. 201.—1-8 in. from Surface of Head, 75-lb. Rail. First Half of Ingot.



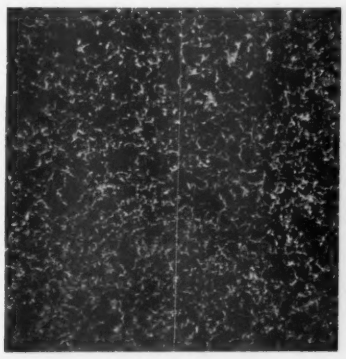
No. 202.—Center of Head, 75-lb. Rail. Section Half of Ingot.



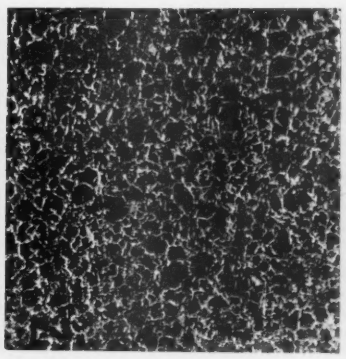
No. 202.—1-8 in. from Surface of Head, 75-lb. Rail. Second Half of Ingot.



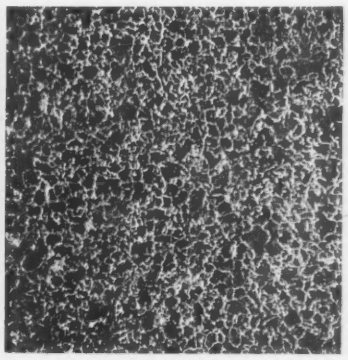
No. 207.—From Center of Head, 75-lb. Rail. Treatment same as 201.



No. 207.—1-8 in. from Surface of Head, 75-lb. Rail. Treatment Same as 201.



No. 208.—Center of Head, 75-lb. Rail. Direct Rolled Rail.



No. 208.—1-8 in. from Surface of Head, 75-lb. Rail. Direct Rolled Rail.

Micro-Photographs of Rail Steel.

It thus seems that to obtain a non-granular structure throughout the rail the temperature must be reduced earlier in the rolling—in fact, the bar or bloom must not be reheated, but should be rolled direct from the ingot. In the latter case the bloom will be delivered to the rail rolls at a temperature of 850 deg. C., while a reheated bloom will be delivered at 1,000 deg. C., or more. I want to emphasize the fact that while the rail is held before the final pass, at a temperature above the critical point, it crystallizes, and the single pass which it subsequently receives is incapable of breaking up the granular structure for more than a certain depth. This practice of direct rolling has been carried on for years in some mills in this country, and in almost all mills abroad. There is no trouble with a granular structure, while the mills rolling reheated blooms have run hard against very granular structure, and thus have this year introduced the method of holding the bar before the last pass. This has greatly improved their structure, but it is not as homogeneous as a structure obtained by direct rolling, as the temperatures are so much above the critical point that the steel becomes granular so easily while being held for the cooling before the final pass.

The microscopic study of rails from these different methods of rolling is interesting, and plainly shows that the bar must be kept at a lower general or average temperature to get the best structure throughout. Usually the method of holding for one and three-quarters to two minutes at 900 to 1,000 deg. C. before the bar goes through the finishing pass allows a very granular structure to develop, which the reduction of the last pass of 5 per cent. will not destroy to a greater depth than ⅛ to ¼ in. toward the center of the head, which, as far as temperature is concerned, is far enough above the critical point to do some more crystallizing after the finishing. If not, the granular structure found comes from the first caused explained—i.e., a per cent. of reduction too small to reach the center effectively.

Our microscopists publish occasionally micro-photographs showing the structure obtained by forging at certain known temperatures, measured with the Lechatelier pyrometer. Prof. Albert Sauveur has published such a set showing steel forged at 650, 850 and 1,100 deg. C., which, if used as a standard for comparing the structures obtained in rails, gives at once a method of knowing actually what temperature the rail had when cooling after being finished and just how far above the critical point. Without a doubt, the proper way to get at this matter of rolling temperatures is through the microscope. This idea is rapidly gaining ground, and the microscopists deserve great credit for the manner in which they have brought forward the microscope practicably.

I am rather disappointed at the method which the railroad people use to decide what the temperature has been by putting into their specifications a shrinkage clause in the belief that this will insure a nongranular structure and hence a low rolling temperature. This is not the correct idea, because shrinkage of different steels varies. Then, too, it is so easy to vary shrinkage by holding at

*Superintendent of the Steel Department of the Maryland Steel Company.

the last pass, by running the engine slowly which drives the finishing rolls, and by the application of water both before (which will help the structure) and after (which does not generally have much effect, as steel is near the critical point). Now a nongranular structure of the rail is ideal, although not practicable, but the requirements of the railroads are such that the mills are all striving to outdo one another in getting as low a temperature as possible and also have the head of the rail homogeneous. Microscopic examination will give the true result, something that cannot be influenced by mankind, as shrinkage can.

In conclusion, I desire to remind my readers that shrinkage continues under the critical point, and hence does not in the least help or indicate the structure. So it seems that shrinkage is very misleading to the railroad people.

The following micro-photographs explain the above article, and were obtained in the following manner:

No. 201 was the first half of an ingot rolled as hot as possible through the 10 passes of the rail rolls to the final pass and there held 1¾ minutes; then through the finishing pass.

No. 202 was the other half of the same ingot, held before going into the rail rolls for two minutes; then sent through the 11 passes at this reduced temperature.

No. 207 was treated the same as No. 201.

No. 208 was treated the same as No. 202.

No. 169 was rolled from a reheated bloom, and sent through the mill extremely hot up to the last pass and there held two minutes. This rail had a shrinkage in 30 ft. of 5½ in., but shows a structure that is not homogeneous, while a direct rolled rail will give a structure similar to Nos. 202 and 208, and still on account of no special manipulation will have a shrinkage of but from 5⅞ to 6 in.

The magnification throughout was 50 diameters.

New Yards and Shops of the Central Railroad of New Jersey at Elizabethport, N. J.

(*Concluded from page 887, Dec. 27, 1901.*)

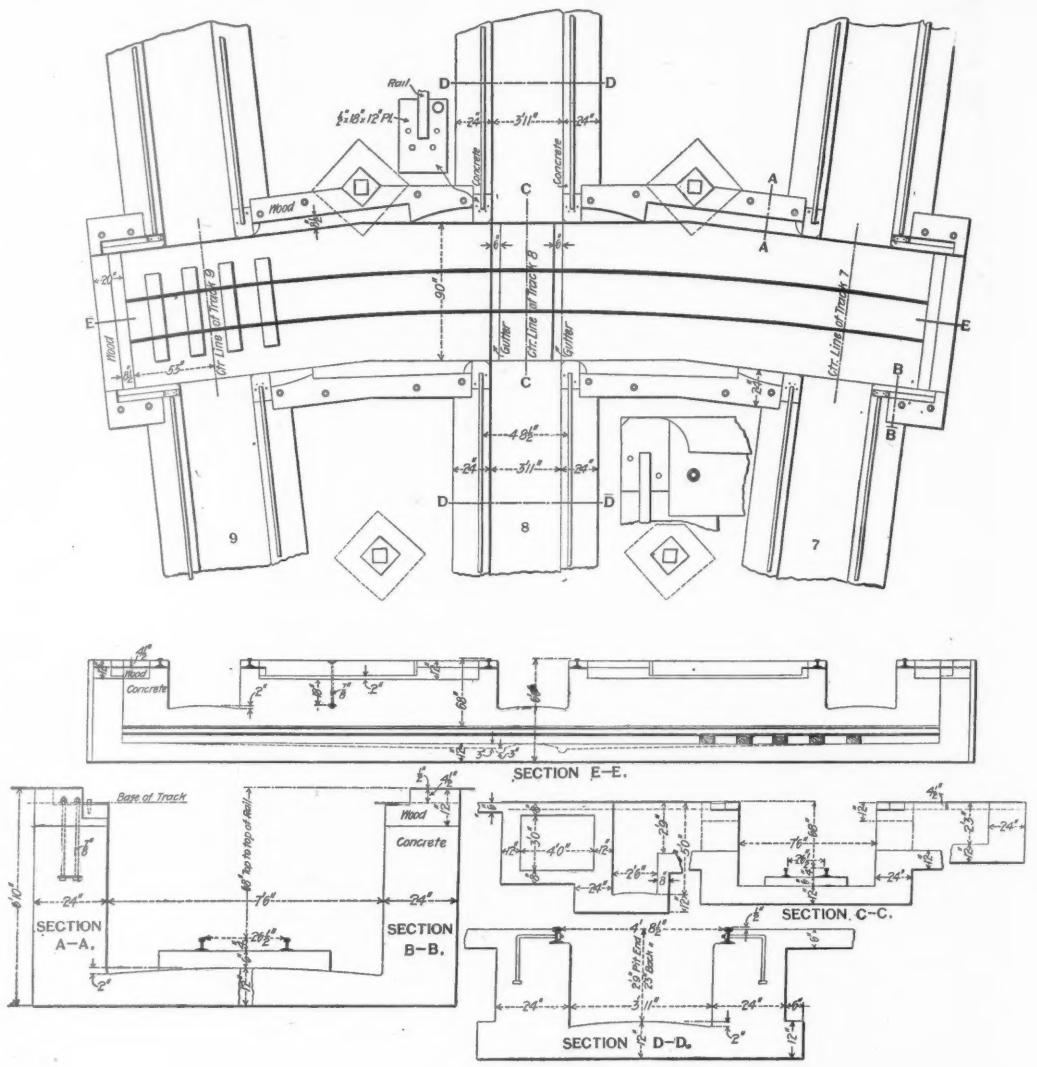
Roundhouse.—The roundhouse has concrete walls 8 in. thick, yellow pine posts, roof timbers and planks, the roof planking being covered with tarred felt and gravel, the posts being carried on isolated foundations and the walls on continuous foundations. The heating tunnels and engine pits are made entirely of concrete with steel imbedded, making the construction of each pit monolithic. Elbow-shaped bolts are imbedded in the side walls to secure the rails, which are leveled with a bed of Portland cement. The inside wall of the house, toward the turntable, is composed entirely of doors and transoms. The roof is nearly flat, but pitches towards the outside. a cast-iron smoke-jack and a cast-iron ventilator are put over each stall. The tracks from the roundhouse to the turntable are supported on concrete walls on which the rails are laid and kept in gage, with wrought iron switch bars placed 5 ft. on centers. The frogs around the rim of the turntable are supported on a continuous concrete foundation 2 ft. thick, the end of the frogs being bolted to a heavy oak curbing carried on the turntable wall. The turntable pit is made entirely of concrete, the bottom following in general the lines of the turntable with a clearance of about 18 in. The pivot for the turntable is carried on a heavy isolated concrete foundation with a granite cap-stone. It is a deck table designed for the standard wheel loads of a 125-ton engine.

The roundhouse will be one of the largest in the country, having a capacity of 52 stalls. It will be equipped with drop pits for handling a single pair of driving wheels and other pits for handling an engine truck, the driving wheel pit being placed on the line of track running on to the transfer table. The heating stack is contained in a separate house, where provision is made for 60 lockers, water closets, bath room, washing sinks, tool storage and office for the roundhouse foremen. Provision is made in the roundhouse for supplying steam to all locomotive boilers, taking the steam from the boilers when they are being blown off, washing down the boilers with water under heavy pressure, and filling the boilers with boiling water.

Storehouse.—This is a concrete building standing on piers with heavy yellow pine platform, the eastern half being made two stories high and contain the shop offices. The first floor is of concrete and metal 12 in. thick. The side walls are of concrete 4 in. thick; the roof is of concrete 6 in. thick, carried on cast-iron columns placed about 16 ft. apart on centers with a skylight of 40 sq. ft. in each bay. The bins for the storage of material are arranged in longitudinal rows and made of wood. All partitions are fire-proof and all communication between the two floors is so made that fire cannot travel from one to the other. There will be pneumatic tubing and telephone connection between the storehouse and all of the various departments throughout the works.

Oilhouse.—This building is of complete fire-proof construction made with concrete side walls 12 in. thick in the basement and 4 in. thick above, the basement practically forming a concrete tank in which the oil tanks are kept. The first floor is of concrete and steel 6 in. thick, with stiffening girders of concrete and steel in combination projecting 12 in. below the level of the ceiling; the roof is of concrete and steel 6 in. thick, made in a manner similar to the floor, the roof slab being supported on cast-iron columns which rest directly on the floor slab. Light is provided by skylights covered with translucent fabric. The concrete roof is covered with ordinary tar and gravel roofing, with copper gutters and flashings. At the rear of the building a large area is placed, covered with a removable plank frame. This is used to admit the tanks. In the basement of the oilhouse tanks are provided for 10 different kinds of oil. The kerosene oil will be raised from its tank by means of a duplex pump operated by compressed air. In all of the other tanks the oil will be elevated by compressed air operated in the following manner:

Beside each tank will be a receptacle of 60 gallons capacity into the bottom of which a 2-in. branch is carried from the main tank with a check valve thereon, this branch being extended 1¼ in. in diam. to a faucet over the filling sink on the first floor; in the top of the receptacle a ½-in. air pipe is placed and runs to the filling sink on the first floor, passes through a valve and connects with the compressed air main. The valves are controlled by a single handle for each kind of oil, so arranged that when the handle is depressed compressed air is permitted to pass into the top of the small receptacle. This closes the check valve between the small receptacle and the tank and forces all of the oil through the other

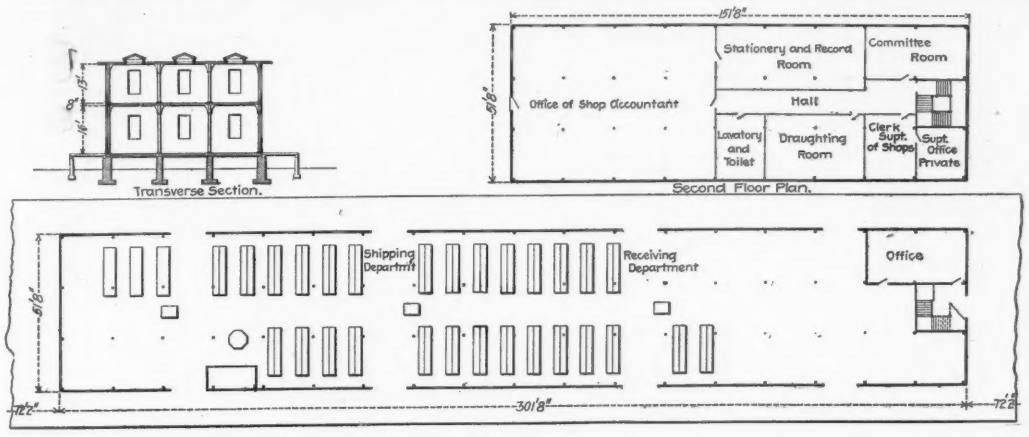


Pits and Wheel Pit.

Part Plan, Elevations and Section.

Elizabethport Roundhouse—Central Railroad of New Jersey.

valve over the sink. Oil can be drawn to any amount up to 60 gallons; should there be an overflow or waste, it goes into the sink from which it is carried back to the large tank. After the small receptacle has been emptied it is only necessary to put the valve back to its first position, when the compressed air is shut off from the main and exhausted from the small receptacle. As soon as the air pressure in the small receptacle drops the oil flows in again from the large tank to fill the small one. The crude oil which is used in the blacksmith shop is contained in a tank in the oilhouse and is lead by a separate line to the blacksmith shop. An electrical circuit runs from the blacksmith shop to the oilhouse and a controlling device is provided in the oilhouse by means of which, when crude oil is desired in the blacksmith shop a valve is electrically operated in the oilhouse to permit of the flow of crude oil as may be required. When this valve is released by the breaking of the current the oil will flow back again by gravity, into the oilhouse tank. A separate room is provided in the oilhouse for the storage of oily waste; this room is provided with fire-proof door, fire-proof partitions, skylights, and no windows. The basement, where all the oil is contained is ventilated by means of a 36-in. Blackman fan, constantly exhausting the air from the room.



Store-House Plans and Section.

Paint Shop and the Car Repair Shop.—These shops will be made with concrete bases, brick side walls concrete-filled pipe columns, plank roofs and longitudinal skylights, the shops being divided into sections by means of fire walls.

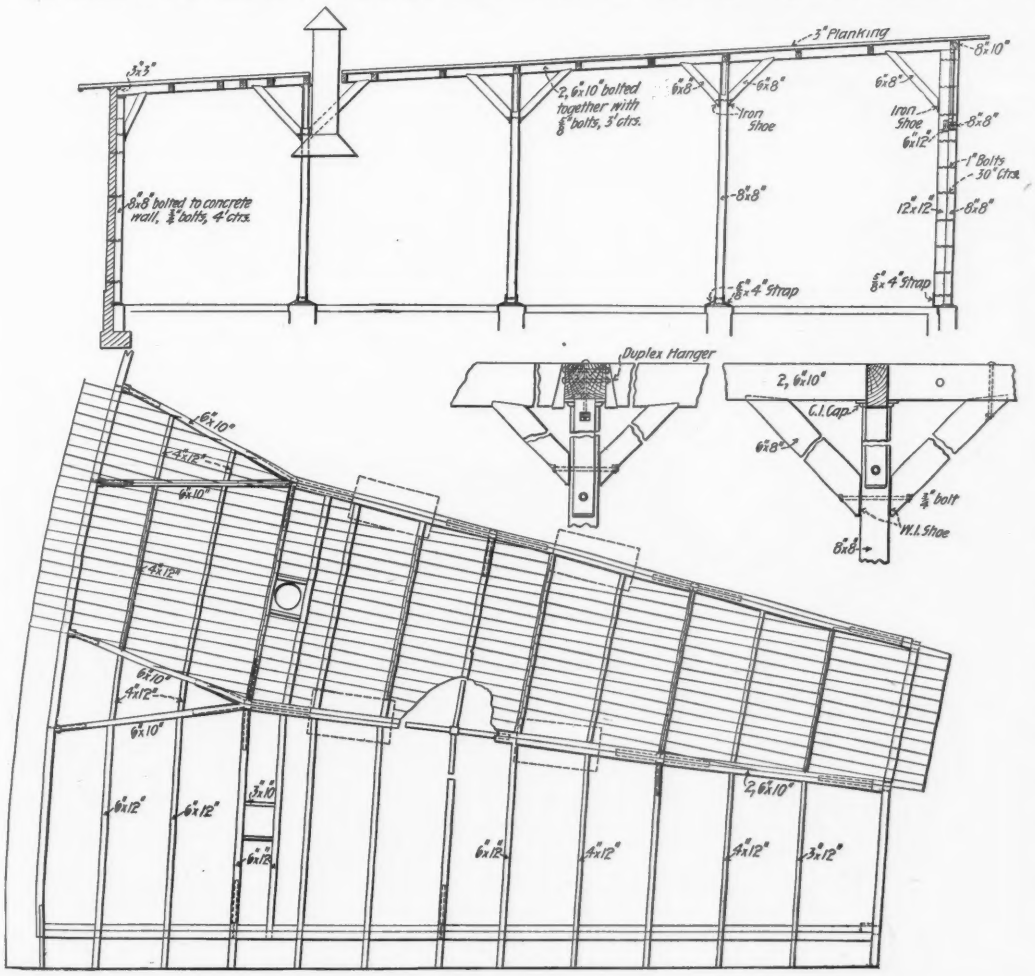
Toilet Rooms are provided in separate buildings with concrete bases, brick side walls, plank roofs, concrete floors; the water closets are of enamelled iron and of the latrine type, and the washing sinks of galvanized iron supplied with clean water and with steam jets for heating the water of the usual factory system. Two of these are provided where they can be readily reached by the bulk of the men.

The cistern is made entirely of concrete and is carried down to the sand underlaying the tract. It will have a normal capacity of 500,000 gals., but can under exceptional circumstances store 600,000 gals.

Heating.—The heating of the buildings throughout will be on the hot blast system, the heating stacks being provided with both exhaust and live steam, fans drawing the air from the building over the stacks and discharging it in general into tunnels built of concrete underneath the floor running the length of the building along the outside walls with galvanized iron outlets 20 ft. on centers, discharging the hot air 10 ft. above the floor in a horizontal direction and toward the ends of the building. In the storehouse and blacksmith shop heated air is conducted along the roof, discharging at an angle of 30 deg. downward. In the roundhouse heated air is distributed through a tunnel with branches, running beside each engine pit and into the pit, there being 12 branches entering the pit; each one of these branches is provided with a damper which, under ordinary circumstances, closes the branch. A certain number of outlet nozzles are provided in the form of bends, which, when put in place, open the damper in the branch pipe automatically, securing the delivery of all of the air against the running gear of the engine. These bends can be rotated so that a very large amount of warm dry air can be discharged under the engine to rapidly free it from ice and to rapidly dry it after cleaning it.

Artificial Lighting.—The general artificial illumination of the buildings and yard is by enclosed arc lamps, and the detail illumination is by incandescent lights, one or more of the latter being placed by each tool.

Skylights.—Translucent fabric is a patented article, but is unique, and consists of a translucent elastic film supported by a very fine wire netting. If the sheet is suspended and fire applied to the edge it will burn up, leaving a carbonaceous covering on the wire. If put in place on a skylight, even though it be one with wooden frames, it does not burn independently and the wire mesh prevents flame passing through it; it is elastic and durable, is not readily injured and is much easier to maintain tight than glass. It shuts off sufficient of the sunlight to make the light uniformly good throughout the shop and to make it possible for men to work directly under it without shading. Where one-fourth or more of the area of the roof is in skylights the lighting is practically perfect, and gives all the advantages of the usual form of saw-tooth lighting with none of its disadvantages. In the machine shop 36 per cent.; in the blacksmith shop, 36 per cent., and in the paint and repair shops, 55 per cent. of the roofs are in skylights.



Roof Plan and Transverse Section—Elizabethport Roundhouse, C. R. R. of N. J.

Sewerage.—Sewerage lines are run as a single main with branches starting at mean high water level at the meadows and carried back at very low slopes throughout the yard; terminal points are in general occupied by toilet rooms outside of which automatic flushing cisterns are provided.

Water Supply.—One 10-in. main and one 8-in. main are brought into the shops from the Elizabethtown Water Co.'s mains at a distance apart of 1,200 ft. They are brought together in the basement of the engine room, where they are so connected to fire pumps that one can be used to supply water to the pumps, and the other used as a distribution main throughout the plant for fire service. The pressure on the mains under normal conditions is 20 lbs. per sq. in.; each main is provided with meters and swinging check valves, water is distributed from these mains throughout the plant in 4-in. cast-iron piping on the loop system; water is stored in a tank of 100,000 gals. capacity supplied from the 10-in. city water main, from which tank an independent line is carried to the fire pumps. A cistern, of 500,000 gals. capacity, is provided near the power house, in which all the rain water falling on the roofs is collected; this is also connected to the suction side of the fire pumps. This gives three independent sources of supply for use in the event of a fire. There are hydrants in the buildings at points 200 ft. apart, and hose outlets 200 ft. apart, alternating with the hydrants. A special electrical pump is provided in the roundhouse for furnishing water at 100-lbs. pressure for washing boilers. A special Gegenstrom water-heating apparatus is also provided for filling the boilers with hot water. The engine tanks will be filled from regulation stand-pipes, two of which will be directly connected to the large tank on one side of the roundhouse, the third on the opposite side of the roundhouse, where it will be convenient for the road engines which do not necessarily enter the roundhouse. In the shops provision is made at various convenient points for drinking-water fountains, which will have ice tanks and water drainage.

Yard Drainage.—The soil over the entire site is a stiff yellow clay which, after each rain, becomes very soft and extremely unpleasant to travel over. The grade of the working floor of the shops was established at a point 10 ft. above ordinary storm tides and about 3 ft. above the average ground height, and at about the elevation of the main line tracks. All excavated material was retained on the site, and wherever excavations were necessary outside of the buildings they were carried to a subgrade 18 in. below that established for the floors. While the buildings are in general at elevation 57 ft., the elevations of finished grade outside range from 54 ft. to 57 ft., the top 18 in. being covered with engine cinders; this affords a reasonably dry and clean covering to the ground and gives the rain water an opportunity to flow off without being mixed or puddled in the clay; the subgrade elevations were determined so as to secure a natural drainage. Wherever pits were necessary, as in the transfer table, turntable, and so on, the drainage was brought together into a main and carried out to the meadows; open ditches were also put in at certain convenient points where their maintenance would not interfere with the yard uses.

Coaling Station.—The coaling station has not been decided upon as the problem presented is unique and very difficult of solution. The design at present under consideration is one involving the use of conveyors which will give a storage capacity of 600 tons, a coaling capacity of 1,200 tons; and will permit of a weighed amount of coal up to 15 tons being discharged into the tender of the engine in 15 seconds with a cost for handling, including interest and depreciation, of 3½ cents per ton.

Personnel.—The plant was designed, erected and equipped by Mr. George Hill, of New York City. Mr. A. J. Slade is Superintendent at the works; Mr. T. M. Niven, Jr., storekeeper and bookkeeper; Mr. H. W. Redfield, Jr., architectural assistant; Mr. A. M. Allen, mechanical assistant; and Mr. F. L. Douglas, structural assistant. The engineering and motive power departments of the Central Railroad of New Jersey gave much valuable assistance and all plans were submitted to them for their approval. Mr. J. H. Thompson, and afterwards Mr. Joseph O. Osgood, Chief Engineers of the Central; Mr. Rogers, engineering assistant, representing the Chief Engineer; Mr. Wm. McIntosh, Superintendent of Motive Power, Mr. S. F. Forbes, Assistant Superintendent of Motive Power, Mr. G. W. Wildin, Mechanical Engineer, and Mr. Denton, chief draftsman, all had part in the work.

The machine tools employed, of which a list was given in our last issue, were all bought through Messrs. Manning, Maxwell & Moore, who were also the agents of the Shaw Mfg. Co., of Muskegon, Mich., manufacturers of the cranes. Shafting, pulleys, etc., the George V. Cresson Co., Philadelphia. Motors and generators, the Sprague Electric Co. Engines, the Ball & Wood Co. Boiler-feed and fire pumps, the Worthington Co. Switch-boards and

panel boards, F. A. LaRoche Co. Rubber-covered wire, the Safety Insulated Wire & Cable Co. Electrical supplies, the Burnet Co. Structural steel, Milliken Bros. Feed-water heater, Improved Berryman, F. L. Patterson. Steam specialties, Ford. Boilers, Babcock & Wilcox Co. Portland cement, the Atlas Portland Cement Co. Air Compressors, the Ingersoll-Sergeant Drill Co. All fans, the Buffalo Forge Co. Oil heating furnaces, the Railway Supply Foundry Co. Paint, the American Lucol Co. Cooke Heating & Power Co., contractor for the piping installation. The Collins Iron Works, contractor for all tanks, breeching and stack. J. H. Spain, of Scranton, Pa., contractor for the installation of all electrical wiring, motors, etc. The Cutler-Hammer Mfg. Co., starting boxes, rheostats, etc. The Buffalo Forge Co., for hot blast heating. W. H. Rankin Co., roofing. John Morrow, contractor for copper work, gutters and leaders. Hay Foundry & Iron Works, the Guerber Engineering Co., contractors for miscellaneous iron work, forging, etc. Geo. P. Nichols & Bro., Chicago, transfer table, complete. Phoenix Bridge Co., turntable. Yingling & Sons, shaking grates.

A Brooks "Chautauqua" Type Locomotive—Central Railroad of New Jersey.

The accompanying illustrations show one of three "Chautauqua" (Atlantic) type passenger locomotives, Nos. 588 to 590 inclusive, recently built by the American Locomotive Co., Brooks Works, for the Central Railroad of New Jersey. These locomotives were built especially for the heavy and fast passenger train work between Jersey City and Philadelphia and they are doing that work well.

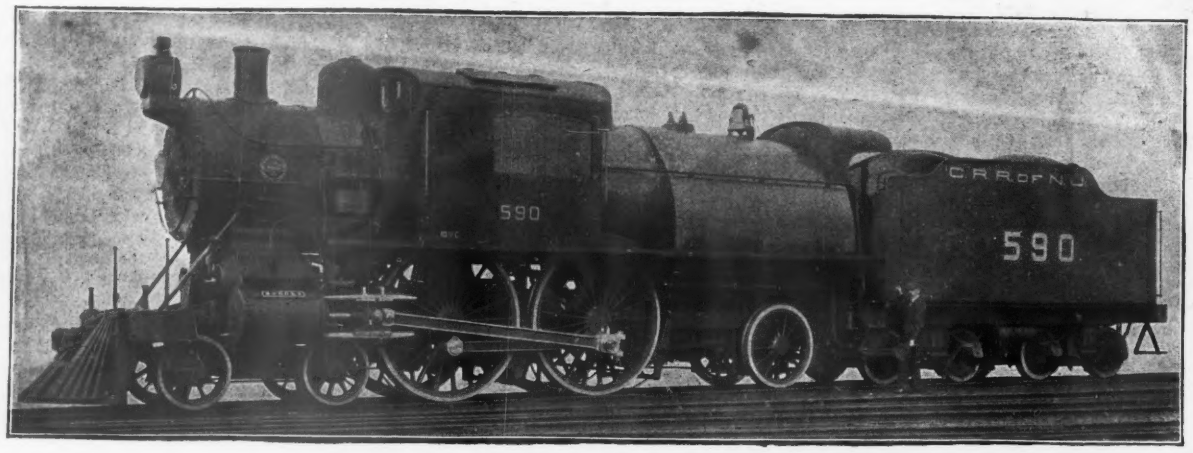
The frames, which are iron, received particular care in design, the intention being to insure that they should not break or loosen, from the heavy work required of the engines. The cylinders are simple 20½ x 26 in., the driving wheels 85 in. in diam., the total heating surface 2,967 sq. ft., grate area (for burning fine anthracite) 82 sq. ft., and working steam pressure 210 lbs. per sq. in.

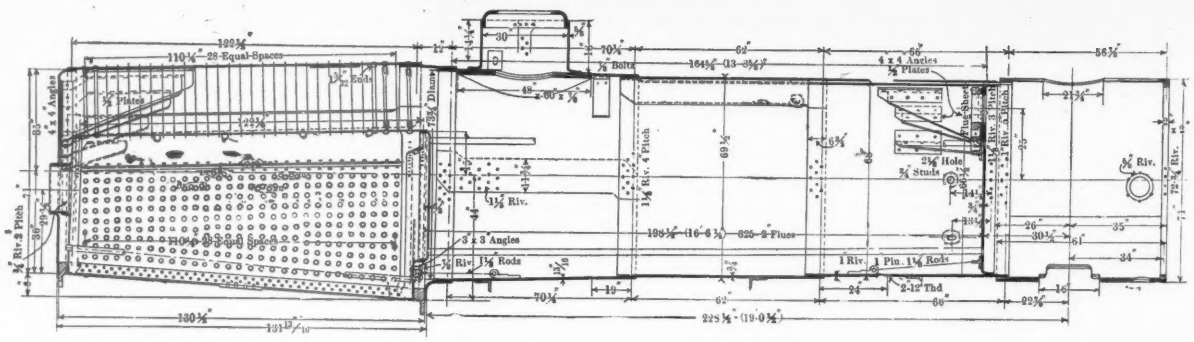
The valves are piston, with inside admission, 1¼ in. steam lap, line and line on exhaust edges, and 5¾ in. travel in full gear. The cylinders and saddle have separate passages for steam admission and exhaust, as designed by Mr. John Player, Mechanical Engineer of the Brooks Works.

The total weight, 190,600 lbs., is greater than that of any engine of this type previously built, but the load on driving wheels, 99,400 lbs., is practically identical with that of the Buffalo, Rochester & Pittsburgh Chautauqua type locomotive, No. 162, which was described in the *Railroad Gazette*, Dec. 13, 1901. There was also given there a comparison with two other noteworthy Chautauqua type locomotives showing how weights and power have been increased since the Burlington, Cedar Rapids & Northern locomotive was described in our issue of Nov. 30, 1900, and the Chicago, Rock Island & Pacific locomotive in the issue of April 26, 1901.

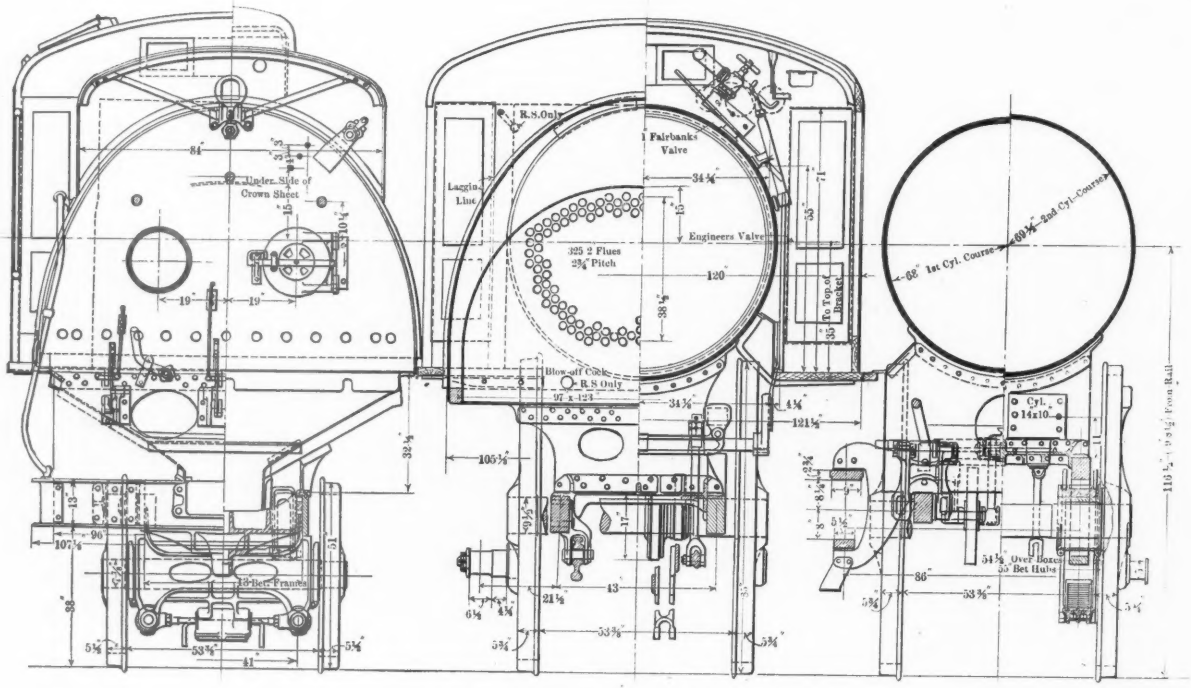
The total of 190,600 lbs. (weighed) is distributed as follows: Driving wheels, 99,400 lbs.; leading truck wheels, 48,000 lbs.; trailing truck wheels, 43,200 lbs. This gives a journal load of nearly 25,000 lbs. per driving axle journal; 12,000 lbs. per leading truck axle journal, and about 21,000 lbs. per journal on the trailing truck axle. The trailing truck is of the latest improved Player (Brooks) radial type, such as we showed in the *Railroad Gazette*, Dec. 13, 1901, as used on the B. R. & P. locomotive.

The tractive effort of the Central of New Jersey locomotives is about 23,000 lbs., with 85 per cent. of boiler pressure assumed as mean effective pressure. The wheels of both trucks and also the driving wheels are big enough for high speed without inviting hot boxes. Thus far the engines

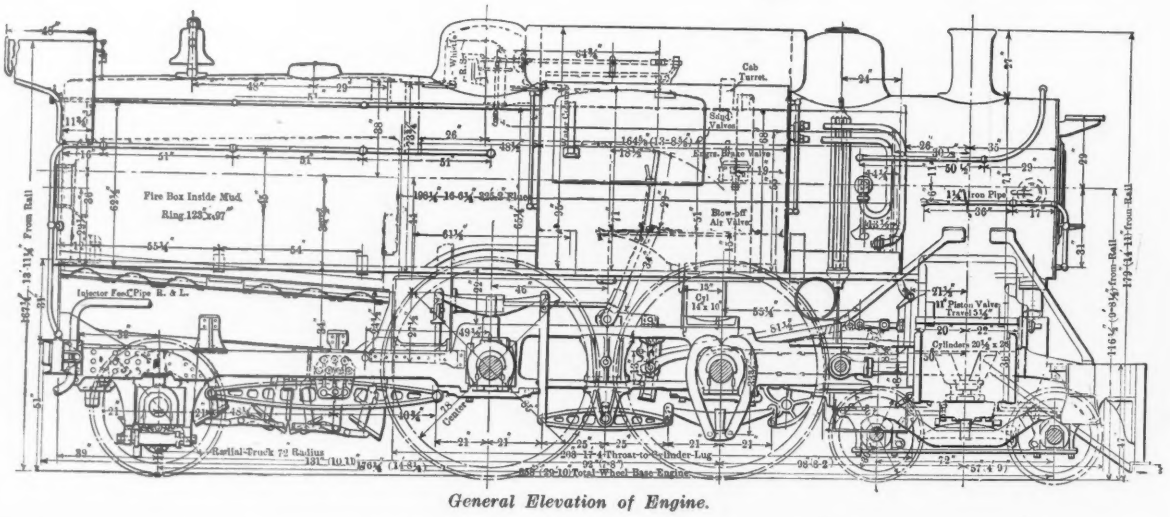




Longitudinal Section of Boiler.



Sections and Elevations of Engine.



General Elevation of Engine.

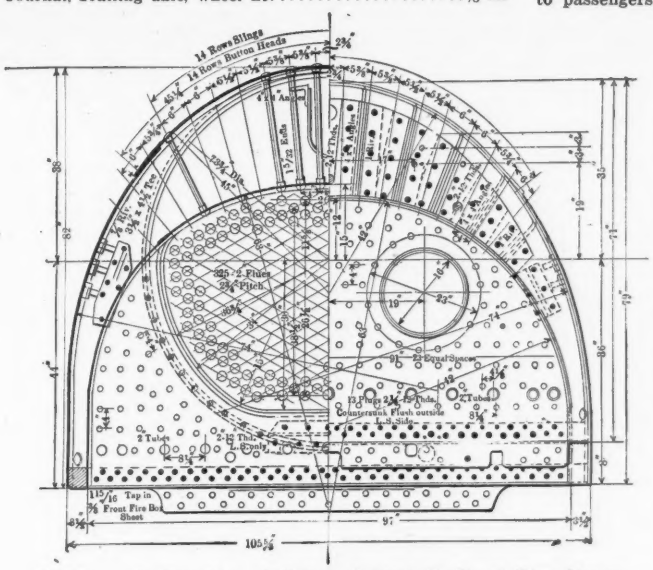
A Brooks "Chautauqua" Type Locomotive—Central Railroad of New Jersey.

have met every demand of the trying schedules they run, and it is felt that their maximum speed has not yet been called for, although some very fast runs have been made.

A general description of the locomotive follows:

General Description.

Fuel	Fine anthracite
Weight on leading wheels	48,000 lbs.
Weight on driving wheels	99,400 lbs.
Weight on trailing wheels	43,200 lbs.
Weight, total	190,600 lbs.
Weight, tender, loaded	124,000 lbs.
Wheel base, total of engine	29 ft. 10 in.
Wheel base, driving	7 ft. 8 in.
Height center of boiler above rail	9 ft. 8½ in.
Height of stack above rail	14 ft. 11 in.
Heating surface, fire-box	174 sq. ft.
Heating surface, tubes	2,793 sq. ft.
Heating surface, total	2,967 sq. ft.
Grate area	82 sq. ft.
Wheels, leading, diameter	36 in.
Wheels, driving, diameter	85 in.
Wheels, trailing, diameter	51 in.
Material of wheel centers	All cast steel
Type of trailing truck	Improved radial axle
Journal, leading axles	6 x 12 in.
Journal, Leading axles, wheel fit	6½ in.
Journal, driving	9½ x 12 in.
Journal, Driving axles, wheel fit	9½ in.
Journal, trailing axle	8 x 14 in.
Journal, Trailing axle, wheel fit	7⅞ in.



Section and Elevation of Boiler—Central R. R. of New Jersey Engine, No. 588 Class.

Cylinder diameter	20½ in.
Cylinder stroke	26 in.
Piston rod diameter	4 in.
Main rod length center to center	140 in.
Steam ports, length	25½ in.
Steam ports, width	1¾ in.
Exhaust ports, least area	75 sq. in.
Bridge, width	3⅛ in.
Valves, kind of	Piston
Valves, greatest travel	5¾ in.
Valves, steam lap (inside)	1¼ in.
Valves, exhaust (outside)	Line and line
Lead in full gear	3/32 in.
Boiler, working pressure	210 lbs.
Boiler, material in barrel	Steel
Boiler, thickness of material in shell	¾ in., 13/16 in., ½ in., 9/16 in.
Boiler, thickness in tube sheet	¾ in.
Boiler, diameter of barrel front	68 in.
Boiler, diameter of barrel at throat	73¾ in.
Seams, kind of horizontal	Sextuple
Seams, kind of circumferential	Triple
Crown sheet stayed with	Radial stays
Dome, diameter inside	30 in.
Fire-box, length	123 in.
Fire-box, width	97 in.
Fire-box, depth, front	59 in.
Fire-box, depth, back	48 in.
Fire-box, material	Steel
Fire-box, thickness of sheets	Crown, ⅜ in.; tube, ⅝ in.; side, ⅜ in.
Fire-box, brick arch	None
Fire-box, mud ring width	3½ in. back, 3½ in. sides, 4 in. front
Fire-box, water space at top	4½ in. back, 5½ in. sides, 4 in. front
Grates, kind of	Rocking
Tubes, number of	325
Tubes, material	Charcoal iron
Tubes, outside diameter	2 in.
Tubes, thickness	12 B. W. G.
Tubes, length over tube sheet	16 ft. 6¼ in.
Smoke-box, diameter outside	71 in.
Smoke-box, length from tube sheet	65½ in.
Exhaust nozzle	Single, permanent
Exhaust nozzle, diameter	5 in., 5 5/16 in., 5⅝ in.
Exhaust nozzle, distance of tip below center of boiler	5 in.
Netting, wire or plate	Netting
Netting, size of mesh or perforations	2½ x 2½ in. No. 12 wire
Stack	Taper
Stack, least diameter taper	15 in.
Stack, greatest diameter	16¾ in.
Stack, height above smoke-box	27 in.

Tender:

Type	8-wheel steel frame
Tank, capacity for water	6,000 gals.
Tank, capacity for coal	12 tons
Tank, material	Steel
Tank, thickness of sheets	¼ in.
Type of under-frame	Steel channel
Type of trucks	Brooks all-metal trucks
Type of springs	Triple elliptic
Diameter of wheels	36 in.
Diameter and length of journals	5½ x 10 in.
Distance between centers of journals	6 ft. 5 in.
Diameter of wheel fit on axle	6⅞ in.
Diameter of center of axle	5⅞ in.
Length of tender over bumper beams	21 ft. 7½ in.
Length of tank inside	20 ft.
Width of tank inside	10 ft.
Height of tank, not including collar	5 ft. 7¼ in.
Type of draw-gear	Williamson & Pries tandem

Special Equipment:

Sight feed lubricators	Nathan
Safety valves	Consolidated
Injectors	Hancock
Steam heat	Consolidated
Springs	French
Metallic packing, piston rods	Jerome
Metallic packing, valve stems	Brooks Works

The Arbitrator's Decision in the Matter of the London Underground.

Cable despatches, the substance of which we have already published, informed us that the arbitrators between the Metropolitan Company and the Metropolitan District Company in the matter of the system of electric equipment to be used for the Inner Circle, had decided in favor of the District (Yerkes) Company. London papers received this week give the report of the Hon. A. Lyttelton, one of the three arbitrators, the essential parts of which follow:

"Parliament has for the first time thrown on the Board of Trade the task of imposing on a railroad company a system of working to which that company is opposed. The system to be adopted on the Inner Circle will have to operate on a circular railroad, in tunnel, through which a dense traffic is carried by trains frequently stopping, and rapidly succeeding each other, and where a large number of trains of foreign companies are at frequent intervals interjected. On such a road it is of vital moment that a service of precise and imperturbable regularity should be maintained. It is, further, requisite that the trains should be handy, i.e., should, without discomfort to passengers, quickly start, accelerate, retard and stop. It is, above all, essential that the system adopted should be safe to the public and the employees. The 'continuous' system is very well known, and it was not seriously questioned by the Metropolitan Company that it had been proved to satisfy the requisites above enumerated by long and well-tried experience on similar railroads, carrying similar traffic, under similar conditions, both in America and England.

"The 'alternating' system, as carried out by Ganz & Co., of Budapest, proposed by the Metropolitan Company, abolishes the rotary converters employed in the continuous system, and introduces into the tunnels where the trains run a current of 3,000 volts, carried on overhead conductors and collected thence into the train motors by trolleys.

"It was admitted that no fully equipped railroad in actual working used a current in the traffic exceeding a pressure of 750 volts, nor have any experiments been made by Messrs. Ganz's proposed system of railroads presenting the peculiar features of the Inner Circle. It is true that certain experiments of this method of traction have been made in the yard of Messrs. Ganz & Co. and on the Sondrio & Lecco Railroad in Italy (not yet opened for traffic) of a very interesting and important character; but those experiments have not resulted in the proposal by the Metropolitan Company for the Inner Circle system of the plant there tested. The motors, the trolleys, the controlling gear, the conductors, the safety devices described by Messrs. Ganz before us as those proposed to be used on the Inner Circle differ materially from those tested as before mentioned, and the maximum acceleration for the motors was changed from 18 ft. to 26 ft. per second; while the system originally a 15-cycle system was changed to a 25-cycle system. It is, therefore, accurate to say that the system tested at Sondrio and at Messrs. Ganz's yards is still in the experimental stage, and that important departures from and amendments of that system were avowed as necessary before us for the Inner Circle.

"It will thus be seen that the Metropolitan Company, who alleged in substance a superiority in economy only for the 'alternating' system, seek against the will of their partner in ownership to displace a well-tried and widely successful system, and to make an experiment under perhaps the most expensive and complicated conditions which could be found in Europe. Such an experiment may very possibly be made on a railroad of a scale where considerations of safety are less vital, where, if any loss ensues, it will not be heavy and will be borne by those only who are responsible for making it; but it is impossible to recommend its trial against the will of the District Company on the Inner Circle. Many controversial matters of great interest from the point of view of electrical science were discussed before us. Upon these questions it is not necessary—and would probably be premature—to express an opinion. It is for the broad reasons already set forth in this report that I advise the 'continuous' system should be adopted on the Inner Circle and on the City Lines and Extension railroads. In this advice Mr. Parshall concurs; Mr. Parker does not dissent, and does not desire to send in any separate report.

"I think it right to add that the manner in which the District Company conducted the preliminary negotiations which took place between the two companies to determine the system of electrical traction was most embarrassing to the Metropolitan Company, and fully justified that company in clearing the matter up by arbitration."

There is a good deal of talk of a combination of the Würtemburg State Railroads with those of Prussia, just as those of Hesse were combined not long ago. The small states cannot work their little railroad systems economically, and the latter have necessarily intimate relations with the great Prussian system. The original proposition of Bismarck was for an imperial railroad system, covering all the states in the Empire; but the small states were afraid of Prussia. They are still loath to abandon their independence; but there is much advantage in working the German system as a whole.

Powers of the Interstate Commerce Commission.

Mr. Walker D. Hines, First Vice-President of the Louisville & Nashville, whose vigorous opposition to the Cullom bill and other legislation designed to change the Interstate Commerce Law, is well known to our readers, has written a letter to the *New York Times*, in which he summarizes the present situation in forcible style. Extracts from this letter follow:

"Much is now said about enlarging the powers of the Interstate Commerce Commission. The importance and effect of the proposed legislation cannot be exaggerated. When once the real scope of this scheme is understood there will be such a sifting of the arguments in favor of it as to disclose their falsity. No substantial change in the present act is proposed in any particular except a radical change whereby the commission is to be given power to make rates. It is strenuously, but falsely, asserted that this is not a general rate-making power. Upon complaint to the commission against any carrier or carriers that any rates, classifications, regulations, or practices are in themselves unreasonable or unjustly discriminatory. The commission may, upon finding the complaint well founded, prescribe what rates, etc., the carriers shall in the future observe in the instances complained of. Since there is no limit as to the number of rates, classifications, regulations or practices, or carriers that may be complained of in a single proceeding, it follows there is no limit to the extent of the direct action of the commission. Under such a power the commission could upon a single complaint, inaugurated by itself, proceed against every carrier in the United States.

"It is contended that there is adequate safeguard against ill-considered exercise by the commission of its tremendous power, in that provision is made for review by the courts. But the rate-making power is essentially a legislative power, and a rate fixed by the commission under such a power would have the same effect as though directly fixed by an act of Congress. The power of review exercisable by the courts is absolutely unavailing. If Congress should directly fix railroad rates, the power of the courts would be limited to setting aside those rates found to be confiscatory in character; and the courts would have exactly the same measure of judicial review over rates fixed by the commission. Therefore, so long as the commission does not absolutely destroy all the profit of the railroads it can rest secure against substantial judicial interference.

"In addition to this insurmountable legal obstacle in the way of judicial check upon the commission's discretion, there is the practical difficulty that the courts would be unwilling, even if they had the power, to go into questions of fact involved, practically converting themselves into so many railroad commissions for that purpose, in order to revise the commission's findings. The courts would regard the commission as the tribunal primarily charged with investigating and finding the facts, and, pursuing the well-recognized policy in such matters, would refuse to disturb those findings except in cases of palpable and flagrant action by the commission.

"Of course, this much vaunted but utterly inadequate judicial review would have no possible application to losses indirectly inflicted upon the carriers not proceeded against, but compelled by stress of competition to meet the rates prescribed by the commission for some competitor.

"Shippers would not have even in form the right of any appeal to protect their interests. The commission may substantially change the relation between the rates of two competing cities, and do gross injustice to one of them, but there will be absolutely no redress. At present the railroads, being substantially identified with the interest of the localities along their respective lines, use every effort to promote the importance of those localities, as compared with localities of other lines, while the present law adequately prevents unjust discriminations as between places on the same line. The proposed legislation involves the destruction of this system to whatever extent the commission chooses to destroy it, and substitutes therefor, at discretion of the commission, the commission itself as the absolute and final arbiter of the relative commercial importance of every place in the United States.

"The question is, Shall the Federal Government now enter upon this radical innovation and make the Interstate Commerce Commission, composed, as it is, of men appointed for short terms, largely by political influences, and presumably unfamiliar with commercial conditions, the most powerful institution in our Government?

"The proposed power has absolutely no relation to the prevention of the one serious transportation evil now existing—that of secret rate cutting, and is absolutely unnecessary to the prevention of any possible transportation evil. While there can be no objection to amending the Interstate Commerce act so as to facilitate, if possible, the prevention of secret rate cutting, and no objection to restoring the pooling privilege to the railroads, coupled with the power in the commission to supervise rates made under such pooling contracts, the proposition to give the commission the general rate-making power has absolutely no connection with either of these objects, but should be considered purely on its own merits."

The Ferguson Flue Furnace.

A number of attempts to use fuel oil furnaces for flue work have been unsuccessful. The principal trouble seems to be that through imperfect combustion and the inability to regulate the air supply, the surfaces of the flues to be welded oxidize in heating and result in imperfect welds. Apparently these difficulties are now overcome in the Ferguson flue furnaces which are being used successfully by some 16 railroads. These oil furnaces, together with similar furnaces, for other classes of shop work are being put on the market by the Railway Materials Co., Old Colony Building, Chicago. There is claimed for these furnaces an economy in fuel when compared with coal and coke fires, but the principal economy is found in the increased output from the oil furnaces. From 60 to 100 flues have been welded in an hour, and one shop reports that the regular output, using a Ferguson furnace, ranges from 500 to 600 flues a day. There seems to be no question as to the quality of the work.

The engravings show the construction of the furnace and the arrangement of the brick work. The furnace consists of a casing of cast-iron bolted together, and lined with from 2 to 3 in. of asbestos and then with fire-brick, the form of the interior being shown by Fig. 1. Only the portion of metal to be heated comes in contact with the hot gases, the passage for which varies from 2¼ to 3 in. in width. The vertical combustion chamber at one end of the furnace is 6 in. sq. and the burner projected upward at the bottom of this chamber. Air is admitted at the bottom of the combustion chamber, and also at the side at a point about level with the hearth. A vent hole and slag hole are left in the brick work at the opposite end of the furnace.

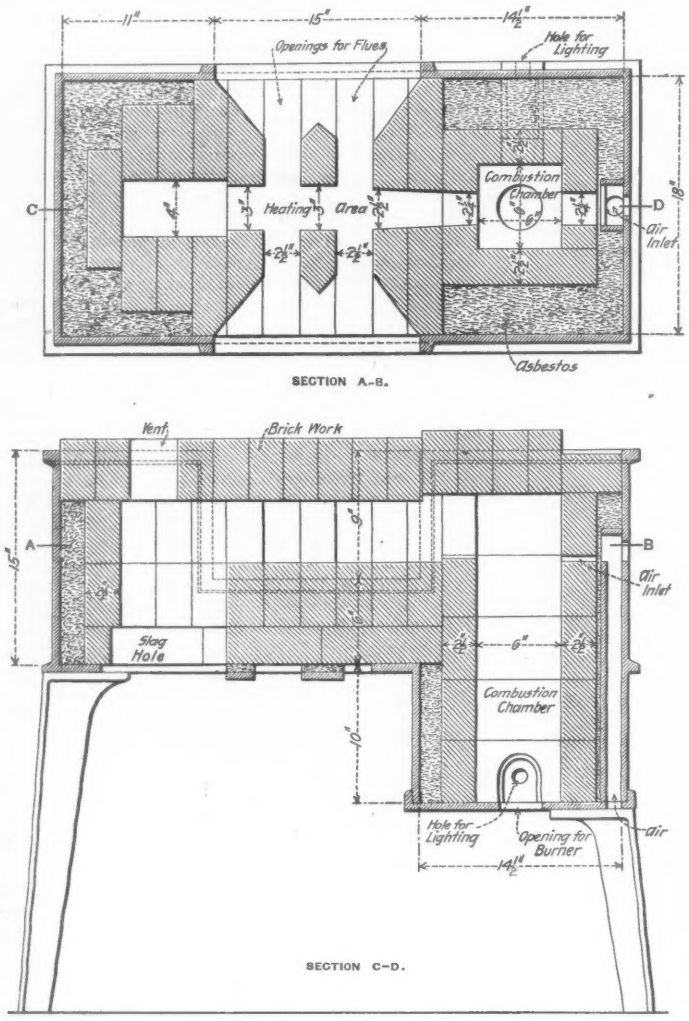


Fig. 1.—Arrangement of Brick Work.

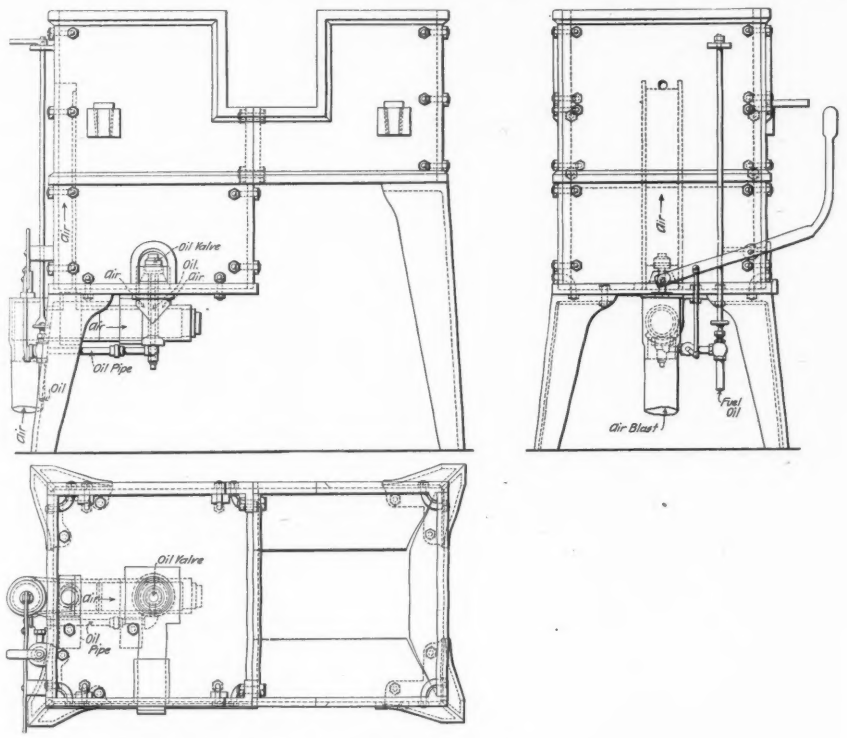


Fig. 2.—Plan and Elevations.

Furguson Flue Furnace for Using Fuel Oil.

The operation is best shown by Fig. 2. The oil is led through a pipe to the furnace, usually from a tank sufficiently elevated to bring the oil to the burner by gravity, or the oil may come from a depressed tank outside the building, in which case the necessary pressure is usually obtained by admitted compressed air above the oil in the storage tank. The oil supply to the burner is regulated by a ¼-in. needle valve. An air blast of 8 oz. is used and the air supply is regulated by a separate valve at the side of the furnace. The burner is annular, the oil passage being the central opening covered by a circular weight valve. The outer annular opening is the passage for the air blast. In operation, the oil rises and flows in a thin film from beneath the weight valve when the oil is met by the air blast, ignited and carried upward through the combustion chamber. The air to complete combustion is admitted through the air inlet near the top of the combustion chamber and this directs the heat out over the hearth of the furnace. By means of the combustion chamber and the independent control of the air and oil supply the combustion is very complete. In starting the fire a lighted piece of waste is introduced through the opening in the side of the furnace just above the burner, and the waste is withdrawn after the oil is ignited.

The details of the furnace are quite simple and the ordinary shopman quickly learns to operate them.

An Indian Engineer in America.

On page 839 we spoke of the recent visit to this country of Lieut. Col. W. V. Constable, R. E., Manager of the Eastern Bengal State Railway, whose report on his observations in the United States has recently been published. Below will be found a very few abstracts from that report, which is voluminous. A short synopsis appeared in the article mentioned above.

Personally, I should be very glad to see a hundred or so of these cars, designed by the dimensions recent and best for India, ordered with a view of actually testing their merits. The weight of live load per foot run compared with existing best practice in India should be the factor in deciding on their merits. Good rolling stock has always seemed to me to be the main factor in successful and economical working, bad stock taking 20 years to replace and hanging like a millstone round the neck of the unfortunate possessor, and it is greatly to the credit of the India Office and the Indian Railway Administration that this important point has not been overlooked in India. The whole of the reporters to the International Congress recognized its importance, and it is to be regretted that the only countries, as represented by their reporters, who argued against taking action and showed lukewarmness in the matter of improvements, were Great Britain and Australia.

There can, however, be no doubt that the difficulties in the way of increasing the revenue compared with the non-revenue tonnage, must, sooner or later, be faced by British railroads, especially as the mineral traffic on British railroads forms 72 per cent of the whole business of the companies. I would go further and predict that the only way by which the British railroads can prevent their dividends steadily dropping and effect large economies in working—thereby giving a share of the benefit to the railroad and a share, by reduction of present excessive rates, to the public—is by building larger and better wagons, some four-wheeled, some bogie, and by altering wholly or partially the turntables, weighbridges, sidings, terminal arrangements, etc., which are now alleged to be an insuperable obstacle. The live load can certainly be increased by raising the height of the sides of ordinary sized wagons and by enlarging the dimensions of the axles, and, as one writer suggests, private wagon owners might be encouraged to improve their stock by basing the charge on the gross weight instead of on the live load of their wagons.

Another point of importance that was brought out during the discussion at the society's meeting was the baneful effect that private owners' wagons had on trade. Even if the difficulties connected with the improvement of the design of traders' wagons could be got over, the empty running and the limit to which such trucks can be used for general traffic makes them most expensive for railroad work. Unfortunately English railroads use some 500,000 traders' wagons out of their total of 1,167,000 trucks, while India has none, and it is to be hoped that any outcry against Indian companies on the score of short wagon supply will not result in the introduction of traders' trucks.

To come back to English practice, it is open to question if weight is not often improperly sacrificed to speed, and I think that merchants and consumers will eventually find it to their advantage to encourage the railway companies to haul heavier trains at slower speed and for a lower charge, except for special classes of traffic.

When at Baltimore I visited, with the superintendent of the line, the coal loading plant at the docks. At the Baltimore Docks there was a wooden pier running out into a basin in deep water with three lines of rail on it, the two outer being working lines and the center track being for empties. On each side of the pier vessels could lie, and at the time I was there a schooner for Boston, of 3,500 tons capacity, was being loaded with coal. It was being filled from four shoots at a time, one shoot being provided for each car. A barge of 1,700 tons had just been loaded in 2½ hours.

The method of working was as follows: Some six 110,000-lb. capacity cars were pushed up the inclined approach of the pier by a switching engine until they stood on the level opposite and above the ship. There, eight men, earning 20 cents an hour as wages, took the possession of a truck and opened the bottom doors, whereupon the coal fell between the track into a shoot and shot straight into the hold of the vessel. It only took 1½ to 2½ minutes to run the coal out, and then the wagon was hauled forward by a horse, unhooked and let run back to the "empties" line by gravity. I omitted to say that there was a weighing machine on each outer track which recorded at one operation the tare and gross weight of the truck. The wagon was in its place on the empty line in less than five minutes from the time the engine pushed it into its unloading position, and it is difficult to conceive anything more simple and inexpensive and less likely to get out of order. The B. & O. Railway officials were certain that it was cheaper and could do far more work than any tipping machinery, and the only drawback is the rough usage the coal undergoes in dropping from the mouth of the shoot over the hatch to the bottom of the hold, but I was told that to a large extent the breakage is being avoided at Curtis Bay by an arrangement under which the stream of coal in the shoot is held up until it arrives close to the point of deposit. The coal under shipment by the B. & O. is a soft bituminous coal and resembles very closely that found in the Bengal coalfields.

It appears to me to be difficult to come to any other conclusion but that the coal traffic of India, which is still in its infancy, should be dealt with in bogie cars of large carrying capacity. This is especially important in respect of coal booked for Calcutta for export. There do not seem to be any great difficulties in the way, such as exist in older civilized countries, where coal screens, sidings, weighbridges, turntables, hoists and terminal plant were designed for handling small wagons.

Working Loads for Manila Rope.*

The technical reference books in use by engineers do not contain definite information in relation to the proper working loads for manila rope, when used in tackle blocks or for cargo hoisting. The hoisting of heavy weights is an important branch of erecting work, and I desire to record in the proceedings of the Society a statement of the result of an extended experience, together with some examples of the life of rope in actual service.

The ultimate strength given in Table II is materially affected by the age and condition of a rope in active service, and also it is said to be the fact that rope is weaker when it is wet. Trautwine states that a few months of exposed work weakens rope 20 to 50 per cent. The ultimate strength of a new rope given in column *B* is the result of tests made by the company with which I am connected of full-sized specimens of manila rope, purchased in the open market, and made by three independent rope walks. The strength given is for ordinary

*Extracts from a paper presented at the New York meeting (December, 1901) of the American Society of Mechanical Engineers, and forming part of Volume XXIII. of the *Transactions*.

commercial rope, which may be greatly exceeded in strength by rope made of selected materials. The table can be depended upon as a reliable and safe guide in estimating the factor of safety for any case in hand.

The proper diameter of pulley-block sheaves for different classes of work, given in columns *F*, *G*, and *H* (Table II.) is a compromise of the various factors affecting the case. An abundance of data is available from which to draw a reasonable conclusion in the premises.

It is interesting to compare the life of a rope when used with the stresses and sheaves given in columns *C* and *F* (Table II.) and one used with those of columns *D* and *G*. To illustrate this, take two cases using exactly the same size and quality of rope; one to be worn out in hoisting coal from vessels, with stresses and sheaves as per columns *D* and *G*, and the other to be used on a rope drive with the stresses and sheaves as per columns *C* and *F*; all the wear on the ropes comes from its internal friction in bending over sheaves, and its external chafing in running on and off them. A record of the number of bends made by each of the ropes will be a convenient means of comparison. A rope 1½ in. in diam. usually hoists from a vessel from 7,000 to 10,000 tons of coal on a well-arranged hoist. The rope will have a working stress of from 850 to 900 lbs. running over three sheaves, one 12 in. and two 16 in. in diam.; in hoisting 10,000 tons it makes 20,000 trips, bending in that time from a straight line to the curve of the sheave, or *vice versa*, 120,000 times. The rope, when this service is completed, is worn out and must be replaced by a new one.

To illustrate the endurance of the rope used in the transmission of power, take a tin-plate mill transmitting 1,000 h.p. to the rolls by means of 1½-in. diam. manila ropes. In one particular case the sheaves are 5 ft. and 17 ft. in diam. and 36 ft. apart, center to center. The rope is 86 ft. long, runs 5,000 ft. per minute, making 13,900 bends per hour, or more bends in nine hours' service than the other rope made in its entire life. As is well known, the life of a transmission rope is measured by years, not hours. This enormous difference in the life of ropes of the same size and quality is wholly gained by reducing the stresses on the rope and increasing the diameter of the sheaves.

The weakening effect given in the table of various knots, hitches, and bends used in rope tackle is based upon experiments made in the laboratory of the Massachusetts Institute of Technology. With care, an eye in the end of a rope having the ends of the strands tapered down, can be spliced over an iron thimble so that it will have substantially the full strength of the rope, but as it is usually made it is not so strong, for which due allowance is made in the table. The same remarks apply to a splice in a rope. In the table some knots are included that were not tested, but whose approximate strength is evident from their formation. The table is

Table II.—Working Load for Manila Rope.

A. Diam. Rope, Inches.	*B* Ultimate Strength, Pounds.	*C.* Working Load in Pounds. Rapid.	*D.* Medium.	*E.* Slow.	*F.* Minimum Diam. of Sheaves in Inches. Rapid.	*G.* Med.	*H.* Slow.
1	7,100	200	400	1,000	40	12	8
1⅛	9,000	250	500	1,250	45	13	9
1¼	11,000	300	600	1,500	50	14	10
1⅜	13,400	380	750	1,900	55	15	11
1½	15,800	450	900	2,200	60	16	12
1⅝	18,800	530	1,100	2,600	65	17	13
1¾	21,800	620	1,250	3,000	70	18	14

TABLE III.—THE EFFICIENCY OF KNOTS IN A PERCENTAGE OF THE FULL STRENGTH OF THE ROPE, AND THE FACTOR OF SAFETY WHEN USED WITH STRESSES, AS PER COLUMN *E*, TABLE II.

I.	*J.* Eye-splice over an iron thimble.	*K.* Short splice in the rope.	*L.* Timber hitch, round turn, and half-hitch.	*M.* Bowline slip knot, clove hitch.	*N.* Square knot, weavers' knot, sheet bend.	*O.* Flemish loop overhand knot.	*P.* Rope dry, average of four tests from the same coil as the knots.
The efficiency of the knot	90	80	65	60	50	45	100
Factor of safety	6.3	5.6	4.5	4.2	3.5	3.1	7

only a guide to be used in estimating the factor of safety. The loss of efficiency by the use of these knots was conclusively settled by the experiments above mentioned, and the numerical value fixed within such narrow limits that the results cannot safely be ignored in executive work.

It will be understood that a table of working loads must be a general one, covering ordinary cases arising in practice. Local conditions may be such as to make it advisable to vary from the stresses given in the tables. In cases of great importance an engineer should carefully investigate the subject in detail, and then decide upon the exact stresses that he will put on his tackle, but ordinary cases are fully covered by the data given in the tables herewith.

In this table the work required of the rope is, for convenience, divided into three classes, "rapid," "medium," and "slow," these terms being used in the following sense:

"Slow"—Derrick, crane, and quarry work; speed from 50 to 100 ft. per minute.

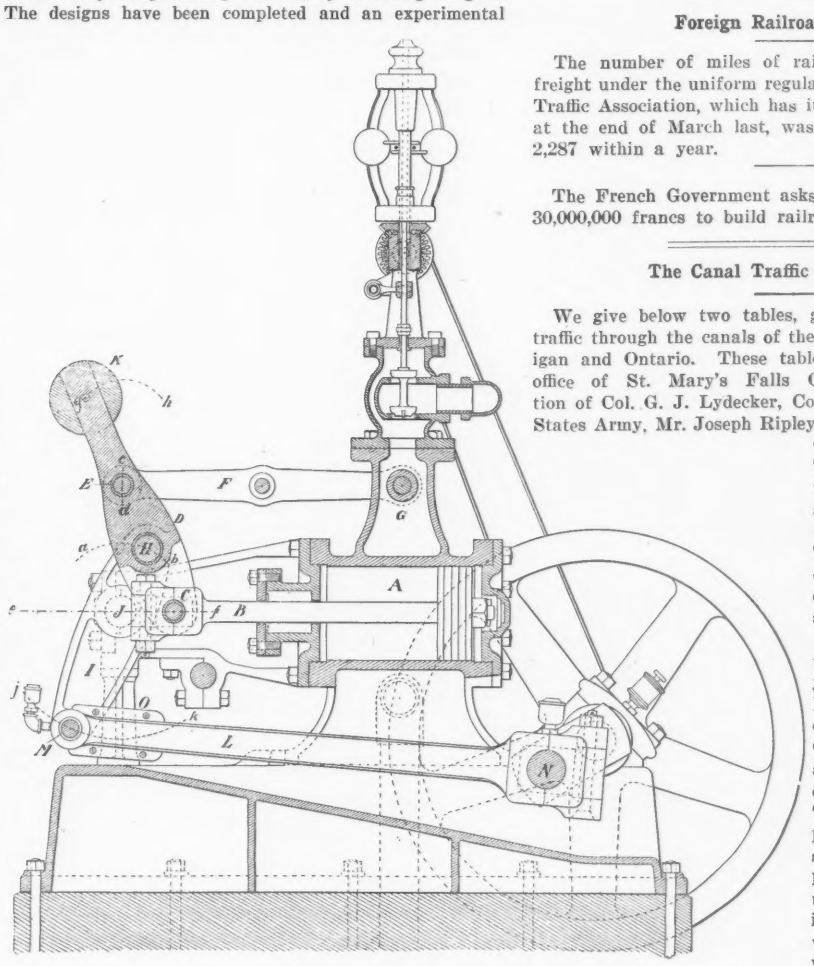
"Medium"—Wharf and cargo, hoisting 150 to 300 ft. per minute.

"Rapid"—400 to 800 ft. per minute.

The diameter of the rope in column *A* is obtained by dividing the girth by 3.1416. This method gives for a three-strand rope nine-tenths, and for a four-strand ninety-three hundredths of the diameter of a circumscribed circle. The girth method corresponds closely to the circular diameter of the rope when under stress, and is the most convenient method to use.

Forney's Balanced Engine.

For some time past Mr. M. N. Forney has been at work upon the development of an engine whose reciprocating parts should be truly balanced. That is to say, the reciprocating parts of the engine itself should be balanced by reciprocating and not by revolving weights. The designs have been completed and an experimental engine built on the lines indicated by the sectional engraving herewith.



Forney's Balanced Engine.

This engine has a cylinder diameter of 4½ in. with a piston stroke of 6 in., and has been mounted on a freely-swinging, spring-supported platform. When the engine is run at speed, there is no vertical or oscillating motion to the platform and no tremor to the engine.

The method of balancing consists essentially in the use of the weight of the connecting rod to balance the motion of the piston and its rod. By an ingenious system of levers the use of a crosshead is dispensed with and, besides being balanced, the engine is remarkably compact.

Turning to the details of construction, the piston rod B is connected by a pin C to the lower end of a primary lever D, the upper end of which is connected by another pin E to a pair of radial links F, the opposite ends of which are attached to the cylinder casing by a pin G. To the middle, H, of the primary lever D a pair of secondary levers, I, are connected. These have fixed bearings at J, and are extended downward, and the connecting rod *L* is attached to their lower ends by a pin M, and, of course, to the crankpin N at the other end. As the center of the pin H moves in the arc of a circle *a b* and the center of E moves in a short arc *c d*, which approximates very closely to a straight line, it will require no demonstration to show that the center of the pin C will move in a horizontal straight line *e f*.

The object of the counterweight K is to counteract the vertical disturbing element due to the movement of the pin M in an arc of a circle. It will be seen that the position of the versed sine of the arc *g h* is reversed in relation to that of *j k*, so that the vertical movements of M and K, being in opposite directions, counterbalance each other.

The engine as so built can be run at 400 revolutions a minute without any perceptible horizontal or vertical movement. It was primarily designed for locomotives, but it is equally well adapted for automobiles, portable, stationary and marine engines, both simple and compound. The principal advantages claimed for the engine are: That it can be more perfectly balanced than any other engine; that it dispenses with the crosshead and guides; that the length is reduced about one-half, and that the piston with its rod can be counterbalanced by the connecting rod.

Foreign Railroad Notes.

The number of miles of railroad which interchange freight under the uniform regulations of the International Traffic Association, which has its central office in Berne, at the end of March last, was 122,878, an increase of 2,287 within a year.

The French Government asks authority for a loan of 30,000,000 francs to build railroads in Tunis.

The Canal Traffic at the Soo.

We give below two tables, giving particulars of the traffic through the canals of the Sault Ste. Marie, Michigan and Ontario. These tables were compiled at the office of St. Mary's Falls Canal under the direction of Col. G. J. Lydecker, Corps of Engineers, United States Army, Mr. Joseph Ripley, Assistant Engineer and General Superintendent. The United States Canal was opened April 26, and closed Dec. 11, 1901; season, 230 days. The Canadian Canal was opened April 20 and closed Dec. 21, 1901; season, 246 days.

The first table gives details of the traffic for the year through each canal. It will be observed that of the total freight the Canadian Canal passed about 10 per cent., also of the registered tonnage. The second table compares the traffic by years, showing an increase of 10 per cent. in registered tonnage, and 11 per cent. in tons of freight. It will be observed that in wheat and other grain there was an enormous increase in the year.

Lake Commerce Through the Canals at the Sault Ste. Marie, Season of 1901.

Articles.	U. S. Canal.	Canadian Canal.	Total.
East-Bound.			
Copper, net tons	86,903	11,698	98,601
Grain, bushels	22,051,033	2,653,021	24,704,054
Building stone, net tons	42,309	4,275	46,584
Flour, barrels	6,431,899	1,202,056	7,633,955
Iron ore, net tons	16,493,916	1,596,702	18,090,618
Iron, pig, net tons	21,683	8,662	30,345
Lumber, M. ft. B. M.	1,060,880	11,244	1,072,124
Silver ore, net tons	.....	.....	.....
Wheat, bushels	43,217,104	9,595,532	52,812,636
General mdse., net tons	51,243	28,480	79,723
Passengers, number	13,828	15,135	28,963
West-Bound.			
Coal, hard, net tons	730,441	74,052	804,493
Coal, soft, net tons	3,352,752	435,891	3,788,643
Flour, barrels	165	230	395
Grain, bushels	5,300	51,193	56,493
Manuf'd iron, net tons	129,819	46,279	176,098
Salt, barrels	389,889	53,885	443,774
General mdse., net tons	380,321	97,997	478,318
Passengers, number	15,873	14,827	30,700
Freight:			
East-bound, net tons	20,930,117	2,157,625	23,087,742
West-bound, net tons	4,651,921	663,402	5,315,323
Total freight, net tons	25,582,038	2,821,027	28,403,065
Vessel passages, number	15,837	4,204	20,041
Reg'd tonnage, net tons	22,222,334	2,404,642	24,626,976

NOTE.—In addition to the above traffic 10,100 cords pulp wood and 9,000,000 ft. pine logs passed over the Rapids, bound for lower Lake ports.

Comparative Statement of Lake Commerce Through the Canals at the Sault Ste. Marie, Seasons of 1900 and 1901.

Items.	—Seasons.— 1900.	1901.	Increase per cent.	Decrease per cent.
Vessels:				
Steamers, number	14,426	14,372	..	..
Sailing, number	4,004	4,482	12	..
Unregistered, number	1,022	1,187	16	..
Passages, number	19,452	20,041	3	..
Tonnage:				
Registered, net tons	22,315,834	24,626,976	10	..
Freight, net tons	25,643,073	28,403,065	11	..
Passengers, number	58,555	59,663	2	..
Coal:				
Hard, net tons	515,515	804,493	56	..
Soft, net tons	3,971,462	3,788,643	..	5
Flour, barrels	6,760,688	7,634,350	13	..
Wheat, bushels	40,489,302	52,812,636	30	..
Grain (other than wheat), bushels	16,174,659	24,760,547	53	..
Manuf'd and pig iron, net tons	135,585	206,443	52	..
Salt, barrels	328,895	443,774	35	..
Copper, net tons	131,066	98,601	..	25
Iron ore, net tons	16,443,568	18,090,618	10	..
Lumber, M. ft. B. M.	909,651	1,072,124	18	..
Silver ore, net tons	110	.....	..	..
Building stone, net tons	48,902	46,584	..	5
Gen'l mdse., net tons	541,397	558,041	3	..

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

Last week, in referring to the output of all the car building works in the United States for the year 1901, we stated that of the total, 28,140 cars were either all steel or had steel underframes, and that we did not know the proportion of each. Revised figures have since been received which make the exact total of this class of cars 26,497, of which 22,288, or a little more than 84 per cent., were all steel. Last year the totals, as stated last week, were 14,464 all steel and 4,140 with steel underframes only.

In the newspaper accounts of the very cold weather that prevailed all over the Central and Western States about the middle of December it was stated, in reports from three different cities, that the power interlocking was frozen up; and that serious delays to passenger trains were caused thereby. From the tone of the statements one would quite naturally infer that there was trouble with the compressed air or electrical apparatus and, therefore, we made inquiry as to the exact cause of the difficulty. The answers show that there was no trouble with power, whatever; and that the difficulty was of the same kind that would happen under similar circumstances with mechanical interlocking. Snow, or ice, or both, in frogs and switches caused all the trouble that there was; and the reason the snow or freezing water was not got rid of appears to have been the usual ones; extra men were not put on the work soon enough. At one city, not mentioned in the press reports, a power interlocking was out of service 24 hours because of the failure of an air-compressor.

The railroads centering in Chicago and Pittsburgh seem to have determined to increase the pay of their yard brakemen and conductors, popularly called switchmen, by about two cents an hour. We cannot state the fact more definitely than this, because the information is unofficial, and the different newspaper accounts do not fully agree; but there seems to be no doubt of the general fact; and one manager speaks as though some of the road trainmen would also receive an increase. A Pittsburgh newspaper says that the pay of yardmen at smaller cities will be advanced one cent an hour. The wages of yardmen have for years been higher in the West than in the Central and Eastern States, and disagreements as to where the dividing line should be drawn have been important factors in switchmen's strikes at Chicago. A purpose to equalize the conditions in this respect is, no doubt, the mainspring of the action now reported. The fact that, in the extraordinary activity now prevailing, the road trainmen have a better opportunity than the yardmen to make extra pay also has something to do with it. A Chicago paper says that the increases now to be made are the result of an agreement which was made at a meeting of the General Manager's Association in that city on the day before Christmas, and that the principal argument there presented in favor of the advance was that increased pay would stimulate the men to greater efforts to relieve the very serious blockades which have hampered the service in nearly all of the large yards for many weeks past. We have no doubt that this principle has an application in this connection; but yet we can hardly believe that soldiering has been so common in Chicago, or in other cities, that a ten per cent. advance in pay will produce such an increase in activity on the part of the yardmen as to make a great difference in the number of cars handled in a day. It is gratifying to see that the different managers and superintendents have voluntarily made an advance, without being forced to it, and we only regret that the roads did not see a way to introduce the piece-work principle. A premium on smart work is one great agency that is needed in train and yard service, and it is by no means certain that it is impossible of application. Payment by the ton seems to be making progress in freight houses, and it has been proposed by Mr. Derr as applicable to train work. Why not in yard work? Again, the advent of the automatic coupler and the air-brake has been accompanied by a marked increase in damage to cars and freight by rough switching. Why not make an increase of pay depend upon an improvement in this respect? However, we do not wish to throw cold water on the ten per cent. increase. We have no doubt that any workable plan for payment by the ton, or on the basis of freedom from damage bills, would show that the roads can give the men both the ten per cent. and the premiums.

The Canal Across the Isthmus.

We suppose that one of the first matters taken up by Congress when it meets again next week will be the canal across the Isthmus. It seems to be taken for granted that the House will pass a bill providing for building the Nicaragua Canal. There seems to be a little more doubt as to the action of the Senate which may perhaps wait until it can know exactly what terms the New Panama Canal Company is now prepared to accept. Mr. Hutin, who as president of that company, appears to have done about all that he could to keep the stockholders from getting anything for their equity in that property has resigned, and it is understood that the secretary-general of the company is on his way to America with a new proposition. Mr. Hutin rested on an estimate of a little over $109,000,000 as the sum which the United States ought to pay to the New Panama Canal Company. The Isthmian Canal Commission fixed that sum at $40,000,000. If the rights and the property of the New Panama Canal Company can be bought for $40,000,000, and if acceptable terms can be made with the Government of Colombia it would probably be better that we should build on the Panama Line than on the Nicaragua Line. Therefore it seems judicious to wait a few weeks and to ascertain precisely what can be done with the new president of the New Panama Canal Company and with the Colombian government. The canal has waited a good many centuries, and a few weeks or months more of delay can do no harm and may do much good.

It is now about nine years since we first began writing on this matter of the canal. January 13, 1893, we printed an editorial article which gave to many editors of the daily newspapers and to many members of both houses of Congress the first really serious notion that it might be as well to stop and inquire a little more closely before committing the United States government to building the Nicaragua Canal; they had taken the Nicaragua route for granted and as beyond question. The Maritime Canal Company was at that time extremely anxious to have the government lend its credit to the enterprise, and that company was much displeased when we pointed out that perhaps it would be just as well to learn a little more about the actual conditions along the line of the proposed canal before plunging into a work of such enormous magnitude.

At that time the company estimated that its canal could be built for $66,466,880. A board of engineers who had been asked to examine the plans of the company raised the estimate to $87,800,000. The Isthmian Canal Commission in its report published a few weeks ago placed the estimated cost at $189,864,062.

The Maritime Canal Company provided for a depth of 30 ft. in general and 28 ft. in the dredged river channels and terminal canals. The bottom width was to be 80 ft. in rock, and 120 ft. in earth, with 150 ft. in the river channels. The maximum dimensions of locks provided for by the company at that time were 650 ft. long and 70 ft. wide. The commission has provided for a depth of 35 ft.; width of locks of 84 ft.; length of locks 740 ft.; for a bottom width of the canal of 150 ft. in the canal proper; 250 ft. in the San Juan River; and 300 ft. in Lake Nicaragua. On curves of less than 12,000 ft. radius the bottom width is increased one foot for each 200 ft. production of radius.

Other very important changes have been made as, for instance, in the matter of the great dam which heretofore has been called the Ochoa Dam; but these which we have indicated are enough in themselves to justify the wisdom of waiting.

It will be seen that the highest estimated cost nine years ago is only about 47 per cent. of the Commission's estimate, and the prism proposed by the Maritime Canal Company would have been inadequate for the needs of warships or commercial ships now existing and building. For instance, the United States is now building warships with a beam of 76 ft. 2½ in., and it does not need a sailor to know that those ships could not go through rock cuts 80 ft. wide, much less through locks 70 ft. wide. Ships now afloat draw 32½ ft. in salt water which means 33½ ft. in fresh water. Obviously, such ships could not have passed a canal with a maximum depth of 30 ft. and a river channel depth of 28 ft. The White Star ship "Celtic," is 698 ft., 8 in. long with 75 ft., 4½ in. beam. The ships now building at New London for the Great Northern Railway, and designed for trade in the Pacific, are 630 ft. with 73 ft. beam. These ships could not have gone through the Maritime Canal Company's locks. In 1898 we used to be told that if the canal had only been built the "Oregon" need not have gone around the Horn; but the "Oregon" went to sea drawing 27 ft. and her beam is 69 ft. Apparently it would have been a hazardous enterprise to take her through a canal with locks 70 ft. wide and with river channels 28 ft. deep. In fact, we never supposed that Capt. Clark would have taken the "Oregon" into the canal if the canal had been built on the lines then proposed. The wisdom of making haste slowly has been sufficiently proved and it is fair now to stop and inquire if it is not wise to take a few weeks more for deliberation. If we can buy out the Panama Canal Company for $40,000,000 ought we not to build on that line?

As we read the Commission report the Panama Route is to be preferred even at equal cost, and the Commission estimates that it ought to cost less; that is, the estimate for the Nicaragua Canal is $189,864,062; for Panama it is, $144,233,358. Adding $40,000,000 as the cost of purchase from the new Panama Canal Company we should have $184,233,358, and the Panama Canal would still be $5,630,000 cheaper than the Nicaragua Canal.

The length of the Nicaragua Canal is 183.66 miles; while the length of the Panama Route is 49.09 miles. The difference of cost due to the difference of length appears in the $45,630,000, and of that, therefore, we need not speak; but the difference of time of transit will appear as long as ships use the canal. By Nicaragua the time is estimated as 30 hours; by Panama, 11 hours and 14 min. for ships of like size and speed in both cases. But the difference of length makes a somewhat proportionate liability to accidental delay and proportionate addition to cost of working and cost of maintenance. The additional liability to delay, of course, cannot be estimated. The estimated difference of cost of maintenance and operation is $1,300,000 a year, which will continue for all time. This difference in cost of maintenance is due also to some other elements than length.

The summit level of the Panama Canal is lower than that of the Nicaragua Canal, and Panama has five locks as against eight locks at Nicaragua. These elements, however, are included in the additional cost of construction, maintenance, and operation given above. The greater added liability to accident due to the fact that Nicaragua has more locks need not be considered, for the Commission has wisely provided for twin locks, this, by the way, being one of the departures from the plans of the Maritime Canal Company.

The amount of curvature affects ease, speed, and security of operation. The Panama Canal has 29 curves, the Nicaragua, 56. At Panama there are 22.85 miles in curves; at Nicaragua, 49.29. At Panama the total curvature amounts to 771 deg. and 39 min. At Nicaragua the total curvature is 2,339 deg. and 50½ min. Of course, the estimate of time of transit allows for the difference in curvature as does the estimate of cost of operation. So perhaps we need not consider that; but the greater amount of curvature necessarily means greater liability to grounding and other accidents. As we have said before, however, the Commission eliminates part at least of this greater liability to grounding by syste-

matically widening the bottom of the canal relatively as the radius of the curve decreases.

The Nicaragua route has to-day no harbors. On the Pacific end there never was one, and on the Atlantic end it has been destroyed by the elements. Panama has harbors which have answered for a considerable traffic for a good many years. The one at Colon requires considerable expenditure for improvement; that at Panama will answer for the present. The Nicaragua Harbor of Gray Town must be rebuilt and after it is built will need to be dredged probably as long as it is used by ships. The one at Brito must be built in what is now the open sea; but the extra cost of building and maintaining these harbors appears in the estimates above and need not be considered here.

The existence of a good working railroad is a great present advantage at Panama, but the value of that appears in the 40 millions of dollars which the Commission thinks we might pay to the Panama Canal Company, namely, $6,850,000, and, of course, its value also appears in the estimate of time for doing the work. The Commission estimates that the Panama Canal could be built in ten years; and the Nicaragua Canal could be built in six years after the necessary preliminary harbor work is done; but that work will take two years, so that the time of building the Nicaragua Canal is put down as eight years.

The relative healthfulness of the two routes seems to be undetermined. The Commissioners evidently think that Nicaragua is, on the whole, more healthful, and yet they warn us that we must expect a great deal of fever when work begins. On the whole they seem to think that this element may be put down as about the same in the two cases; and they dispose of the question of earthquakes in the same way.

For ships trading between our Atlantic ports and our Pacific ports, and for ships trading between our Atlantic ports and the Orient the Nicaragua route will be shorter by about one day; for our Gulf ports the advantage is nearly two days. But for ships trading between our North Atlantic ports and ports on the west coast of South America the Panama route is shorter by about two days; and for ships trading to and from the Gulf by about one day. These estimates take into account the time of transit through the canals. The matter of doldrums in the Bay of Panama is dismissed very lightly in that sailing ships are fast disappearing from the ocean, and it does not seem as if they should be seriously considered in this great project.

Annual Reports.

Union Pacific.—The long-delayed annual report for the fiscal year to June 30 last was issued late last week. It is an important record of the development of the railroad, entirely apart from the extraordinary events in connection with the Southern Pacific and Northern Pacific stock purchases, with which the company became concerned during the year. On these latter matters only brief comment appears, and little that is new is told of the position of the company in relation to either, except details of the manner in which the Northern Pacific stock was financed in the company's organization.

The directors consider the Southern Pacific and the Northern Pacific stock purchases together, although the one took place in May, and the other in January, and when the controlling interest in the Southern Pacific was bought no idea was held of the extension of the Union Pacific's interest into Northern Pacific matters. The report says of these purchases: "The vital importance of securing for the Union Pacific System its due proportion of the tonnage and revenue tributary to its lines, rendered it essential, that steps should be taken to maintain and protect the position of the system and to safeguard its future against combinations of other lines, which might divert much business by changes in existing channels of transportation. In furtherance of this policy and for the purpose of developing and extending the business of the system and opening new channels of interchange, the Directors deemed it necessary to acquire $75,000,000 par value of the capital stock of the Southern Pacific, and $78,108,000 par value of the stock of the Northern Pacific. The geographical position of the Union Pacific with regard to the Southern Pacific and Northern Pacific afforded many opportunities for important interchange of business; and the acquisition of these stocks has greatly strengthened the position of the system and enabled it to undertake the development of new avenues and sources of traffic.

"Many radical improvements on the Southern Pacific have been inaugurated and are being carried forward. These embrace a comprehensive scheme of placing these lines in a position to render a better service at a reduced cost, and include the reduction of grades and curvatures, new alignment to secure economical operation, and the purchase of new and better equipment and motive power. The nature of these improvements corresponds with those already completed upon the Union Pacific, which have shown such satisfactory results in service and net revenue. The extensive use of oil as a more economical fuel than coal also necessitates large expenditures, which should result in substantial economies.

"The title to the Northern Pacific stock has been vested in the Oregon Short Line Company, and the latter company has provided for the purchase by the issue of purchase-money certificates of indebtedness, which are held by the Union Pacific Company."

These purchases were provided for by issue of $100,000,000 debenture bonds having rights of conversion into common stock, and on June 30, $6,043,000 had been so converted, leaving $93,957,000 outstanding. The other charges in outstanding capital comprised the issue of $3,000,000 Union Pacific bonds (besides $119,500 issued in exchange for Oregon Short Line bonds), $2,033,000 Oregon Short Line 5 per cent. bonds, heretofore held in Union Pacific treasury, and, in addition, $341,000 preferred and $552,500 common stock in conversion of securities of the Oregon Lines. Outside of the issues under the latter head, the directors say of the remaining $105,033,000 new capital supplied in 1901 that "the proceeds of all securities sold have been applied toward the building of new lines, for betterments and new equipment, and for the acquisition of stocks of the Southern Pacific and Northern Pacific companies as stated below."

In payment of Northern Pacific stock, the Oregon Short Line has issued $61,000,000 Northern Pacific purchase money certificates, all held by the Union Pacific, which in turn has issued convertible debentures, besides the $2,033,000 Oregon Short Line bonds, probably also issued on the same account. In addition, the capital accounts show that the Oregon Short Line has current liabilities of $23,202,000, explained as "incurred in acquisition of securities of other companies, and in new construction." Including this sum the Union Pacific's balance of current liabilities over current assets is $25,780,000, against an excess of current assets of about $4,100,000 in 1900.

No reference is made to the readjustment of Northern Pacific stock capital in November last, under which the preferred shares will be retired at par, and the Union Pacific thus loses its majority in Northern Pacific stock. Under the terms of that settlement plan, however, it will increase its common stock holdings to about $71,000,000 out of the $155,000,000 at which the stock will remain. This will give it about $82,000,000 in the new Northern Securities Co.'s $400,000,000 capital stock on the conversion of Northern Pacific stock for that of the Northern Securities Co. Practically, then, Union Pacific can no longer be regarded as a directing force in the Northern Pacific, in which, for a few months, it held a majority of the stock, without attempting to direct its policy, but it will retain $83,000,000 stock in the company now controlling that company and the Great Northern, besides having a voice in the management of the Burlington Railway directly, and through its Northern securities stock holding. The company, of course, will have interest to pay, because of the May stock purchase episode, but the present outlook is that dividends receivable will more than equal charges incurred.

Excluding the Northern Pacific the Company will direct the policy of an enormous railroad system. The Union Pacific proper has 3,011 miles earning $25,472,600 gross in 1901; the Oregon Short Line has 1,439 miles, earning $9,673,300, and the Oregon Navigation has 1,093 miles of rail line, earning, with the water lines, $8,392,000. The ownership of $75,000,000 out of about $197,832,000, gives the manager control (including the Southern Pacific) over 9,000 miles of rail lines and very extensive water lines, which, in 1901, earned over $90,000,000 gross receipts. Southern Pacific, however, is independently operated, and the following statements include only the Union Pacific System lines directly operated:

	1901.	1900.	Increase.
Average miles	5,543	5,431	112
Gross earnings	$43,538,181	$39,147,697	$4,390,484
Expenses and taxes	24,587,145	21,427,546	3,159,599
Net	$18,951,036	$17,720,151	$1,230,885
Other income	3,220,966	2,743,518	477,448
Total net	$22,172,002	$20,463,669	$1,708,333
Charges	9,014,231	8,316,081	698,150
Balance	$13,157,771	$12,147,588	$1,010,183
Preferred dividends	3,979,580	3,952,870	27,710
Common dividends	4,000,014	3,350,757	649,257
Surplus	$5,178,175	$4,843,962	$334,213
Betterments	1,500,000	2,000,000	*500,000
Balance	$3,678,175	$2,843,962	$834,213

*Decrease.

To this surplus income might properly be added $781,080 accrued dividends on Northern Pacific stock holdings, as interest on the bonds issued to pay for that stock, is included above. This gives the balance earned on the common stock above the 4 per cent. dividends on the preferred shares, as $9,958,000, very nearly 10 per cent. on the outstanding common shares, $102,030,000, on June 30. This result was attained in a year when extraordinary improvement work was going on, which must have added to cost of traffic movement for the time being besides enlarging operating expenses in maintenance accounts. Of the total increase of $3,140,000, or 15½ per cent., the larger share, $1,871,500, was in the maintenance departments, and $1,105,300 in cost of transportation. The increase in cost of maintenance of way resulted chiefly from the greater amount of work done, material used, and higher prices paid for material. The increase in maintenance of equipment is accounted for largely by repairs to locomotives and freight cars, and partly to increased charge for engines and freight cars worn out and retired.

Improvement work was prosecuted on an extraordinary scale, and in the three lines operated called for an expenditure in excess of $12,000,000, as shown in the table below, printed in the report:

	Betterments.	New equip.	Total.
Union Pacific	$6,716,282	$2,335,426	$9,051,708
Oregon Short Line	1,099,272	1,119,178	2,218,450
Oregon R. R. & Nav.	701,416	117,155	818,572
Total expenses	$8,516,970	$3,571,759	$12,088,730

The greater share of the cost of this heavy betterment work, or all of it, was met out of the company's surplus in some form, as the capital issues are accounted for in other ways. Only $1,500,000, however, was specifically set aside out of income as a betterment fund, and the expenditure is treated in the accounts as a charge against capital, pending adjustment.

Of the $6,716,000 betterment expenditure charged against the Union Pacific proper $4,498,000 is noted as being on account of the changes of line, which have been reviewed heretofore in these columns. The brief summary of the work, now made for the information of the shareholders, shows that the changes on five sections involved building 88 miles of new line, of which the longest was between Rawlins and Tipton, 43 miles, and the next, 30 miles, near Laramie. In addition, the change of line between Leroy and Bear River, 21⅔ miles, has been completed since June. Of this whole work the directors say they "expect to effect immediate and permanent economies in the cost of operation as a result of the improvements and betterments which now approach completion, and to secure a better service to the public at a reduced cost."

In another way, the extent of the improvement work is shown, the freight train load on the Union Pacific proper, being 354 tons, including construction material, and the revenue trainload 90 tons less, at 265 tons, the latter unit increasing 27 tons, or 11 per cent. over 1900, and the total trainload being 25 tons higher.

Southern Pacific Company.—The report of the Southern Pacific Company for the year ending June 30, 1901, was issued late last week. The main results of operation of all lines are given below. In these quantities are included the Houston & Texas Central and lines in Texas subsidiary thereto, and the Cromwell Steamship Company.

	1901.	1900.
Average miles	8,655	8,215
Gross receipts	$77,244,898	$68,689,818
Operating expenses	49,098,027	44,954,210
Net earnings	$28,146,871	$23,735,608

It will be observed that the increase in gross earnings was 12.45 per cent. The greatest increase was from freight traffic, namely, 16.82 per cent., or 7¼ million dollars. Operating expenses increased 9.22 per cent. and net earnings 18.59 per cent. The principal traffic statistics were as below:

	1901.	1900.
Passengers carried	27,416,113	25,263,151
Passenger-miles	935,143,326	858,491,798
Passenger-mile revenue	2.246c	2.182c
Tons freight carried	17,725,632	15,436,110
Ton-miles	5,694,770,640	4,970,886,710
Ton-mile revenue	0.997c	0.976c

The figures include company freight as well as commercial freight. It will be seen that the freight movement increased 14.56 per cent.

After the payment of fixed charges, and for betterments and equipment, the surplus for the year amounts to $3,456,561, being a decrease from the year before of $462,000. But very heavy expenditures had been made in betterments, and for new equipment, and charged to income account. The total of betterments and additions to proprietary lines and of new equipment therefor amounted to $5,956,000, and the increase over the preceding year was $2,940,000. Besides this there was an item of cost of new equipment to be delivered before December 31 and chargeable to this year's operations amounting to $847,800; and an item for betterments and additions on non-proprietary lines of $66,340.

The capital stock of the Southern Pacific Company outstanding at the beginning of the year was $197,832,148. This was increased during the year by $15,640. The aggregate stocks of the Proprietary Companies outstanding at the beginning of the year amounted to $291,273,572. The aggregate of the stock of companies acquired during the year is $12,516,000, and there was a small issue during the year on account of new lines built. Thus the stock of Proprietary Companies outstanding at the close of the year was $303,924,572. Much of the greatest part of this was owned by the Southern Pacific Company.

Considerable expenditures were made for equipment, improvements, and extensions, and charged to capital stock. This amount after deducting proceeds of property sold or taken over remains $5,180,902.

The following items of rails, ties, and tie-plates were used in making repairs and renewals on all lines, namely: Miles of new rails, 511.44; burnettized cross ties, 1,487,000; other cross ties, 1,410,000; tie plates, 5,078,000; 75,000 tons of rail of 80 lbs. section have been contracted for to be laid in the current fiscal year. The general report is signed by Mr. Tweed, Chairman of the Board of Directors. The statistical tables are, as is customary with the reports of this company, unusually full.

The British Board of Trade is able to report, for the first half of 1901, that not a single passenger was killed in the United Kingdom by a train accident. In 1900 the number killed in six months was 14. The number re-

ported injured for the first half of 1901 is 172; for the corresponding period of 1900 it was 483. The report now before us, which has just been issued, contains, with the usual tabular information, reports of inspections of accidents and casualties under three heads; those of (1) inspecting officers, (2) assistant inspecting officers, and (3) sub-inspectors. The work of the sub-inspectors, who were appointed two or three years ago, has already been mentioned in these columns. Their reports, having to do with accidents to employees, not connected with train accidents, appear in the blue-book in the shape of condensed summaries. These reports in the present case fill 35 pages. The reports of the "assistant inspecting officers" are given in full, the same as those made by the engineer officers, but the cases which they deal with appear to be of the same class as those which are reported on by the sub-inspectors. Presumably, these full reports, which in the present case occupy 17 pages, have to do with the more serious accidents of the class referred to. The engineer officers' reports in the present book fill 58 pages, covering 12 cases. Since the death of General Hutchinson a new name has appeared among those of the engineer-inspectors, and the list now comprises Lieut.-Col. H. A. Yorke; Maj. J. W. Pringle; Lieut.-Col. P. G. Von Donop, and Maj. E. Druitt. The assistant inspecting officers are J. H. Armytage and John P. S. Main; and the sub-inspectors are A. Ford and J. J. Hornby.

A Decision In the Matter of Engineers' Valves.

Just as we were going to press last week we received the text of a decision in a suit brought by the Westinghouse Air Brake Company against the New York Air Brake Company. We could then only prepare a very brief note concerning the matter and that was printed on page 897 of our issue of Dec. 27. The decision was rendered in the United States Circuit Court, Northern District of New York, by Judge Coxe. The opinion is elaborate, clear and comprehensive. We give space below to a few extracts from it omitting, however, the technical statement of the claims at issue and description of the mechanism of the two valves in suit:

This is an equity suit for the infringement of letters patent No. 401,916, granted to George Westinghouse and Frank Moore, April 23, 1889, for an improved engineer's brake-valve. The specifications contain the following general statement:

"The object of our invention is, primarily, to provide for such gradual opening and closure of the valve which controls the discharge of air from the brake pipe as to cause a substantial equalization of pressure in the brake-pipe and uniform application of the brakes throughout the length of the train, and obviate the liability to release the brakes on the forward cars in long trains, which has heretofore been found to be induced by an inequality of pressure in the brake-pipe occasioned by the quick release of a considerable quantity of air and the sudden closure of the discharge-valve thereafter, and from which the breaking of the train into two or more sections has sometimes resulted."

The defendant's valve is made under letters patent No. 504,290 granted to Vaughan and McKee, Aug. 29, 1893. The only defense argued is that of non-infringement.

A perusal of the decisions will demonstrate the extent of Mr. Westinghouse's contributions to the art. He was constantly engaged in an effort to correct existing defects, and, as new difficulties arose, he set himself to the task of overcoming them with a persistency that never faltered. The present system is the evolution of a quarter of a century of patient and restless endeavor.

The patent in suit relates to an improvement designed to remedy certain defects which were developed when a long train was being stopped at stations or slowed down without being brought to a standstill. Prior to the invention in question the engineer in making a service stop or slowing down opened his brake-valve a little, permitting the escape of a small quantity of air, and then slowly closed the valve. The closing, being regulated by hand, was not uniform and sudden action was frequently followed by serious consequences. The reason that the hand closed valve was imperfect and dangerous may be briefly stated as follows:

In order to set the brakes a reduction of pressure in the train-pipe is necessary. The air is released by the valve on the locomotive and the brakes at the forward end of the train are the first to feel the effect of the opening of the valve. In the meantime the compressed air in the rear portions of the train-pipe, which, on freight trains, is often over a third of a mile in length, is moving towards the vent with increasing momentum. If the vent be suddenly closed the air is piled up, so to speak, at the forward end of the pipe, thus exerting sufficient pressure to release the brakes on the cars at the front end of the train. The forward surging of the air operates to set the rear brakes and release the front brakes, thus causing the train to be pulled apart.

The defect was a serious one, everyone recognized it and its cause, but for a long period no one found a satisfactory cure. What was needed was an engineer's valve which would secure a uniform reduction of pressure throughout the longest train-pipe, so that the brakes, on all the cars alike, would be released at the same time.

After several years of experiments such a valve was secured by the efforts of Westinghouse and Moore. They succeeded in producing a slow-closing of the vent port, which closing is accomplished automatically beyond the volition and control of the engineer. It is enough to say for present purposes that the valve accomplished the desired result. In the language of the specification: "The slow and gradual downward movement of the piston in closing the discharge-valve admits of a sufficient time for the equalization of pressure throughout the entire length of the brake-pipe, and thereby insures a substantially uniform application of the brakes on all the cars of a long train." In short, the patented valve is an almost perfect train controller.

That the complainant's valve involves invention is, of course, conceded, and that it was invention of high order cannot be successfully disputed. It was the first engineer's valve which gave him complete control of a very long train under all ordinary conditions. It was the first valve, having those characteristics, which was commercially successful. There is nothing in the prior art which materially affects the invention except what was done by Mr. Westinghouse himself. It is argued by the defendant that in view of the prior Westinghouse structures the claims of the patent in suit must be limited so that they do not include the defendant's device. It must be admitted that this proposition is one that does not commend itself strongly to a court of equity. The court should not, it would seem, be overzealous in searching in the complainant's own arsenal for a weapon with which to give the *coup de grace* to the patent. To restrict the claims within such narrow limits that every ingenious mechanic can infringe with impunity is to destroy the patent. The new result accomplished by the invention was the absolute control by the engineer of a long train of cars while "graduating" or making "service" stops.

Unquestionably the best references introduced by the defendant are the two engineer's valves known as "B 12" and "C 7." These were both constructed under the supervision of Mr. Westinghouse and were tentatively introduced by the complainant. About 100 of the B 12 valves were made in 1885, 1886 and 1887, and 2,116 of the C 7 valves were made in 1887 and 1888. Seventy-five of the former and all of the latter were put into actual use on locomotives.

The complainant insists that neither of these can be considered for the reason that they were merely experimental steps which, in January, 1889, finally culminated in the completed invention.

Generally speaking, the difference between the patented valve and the C 7 valve is that the former operates successfully and the latter does not; the one succeeded, the other failed; the one was tried and went into general use; the other was tried, found wanting and discarded. One of the complainant's experts tersely sums up his opinion of the two valves as follows:

"As to the value of differences between the two valves, there scarcely can be a comparison, for the reason that the C 7 valve is impractical and inoperative, and it is doubtful, if the railroads had to depend upon it, whether the quick-action brake of to-day could be used with any degree of certainty or usefulness; whereas, the valve of the patent in suit is of the highest value, as it not only overcame all the existing difficulties, but afforded a reliable and practical means by which the quick-action brakes are made so useful and effective in handling the long and heavy trains of the present time. Furthermore, the valve of the patent in suit was the first in the art to fully and completely fulfill all the requirements found necessary in the manipulation of the quick-action brakes, and, therefore, its value is unquestioned when compared with all brake valves preceding it."

The differences thus briefly outlined are radical and important. The changes made in the old valve were sufficient to transform a useless machine into a highly useful one. Conceding that the C 7 valve was presented to the public the court is unable to understand why the gift carried with it the subsequent improvements which made it a successful structure. Giving to everything legitimately in the prior art its full significance, nothing is found there which seriously limits the claims in the essential features upon which the invention rests.

Westinghouse and Moore were the first to construct a perfectly reliable and highly efficient engineer's brake-valve. The features which combine to make the defendant's valve successful were appropriated directly from the patented structure.

The complainant is entitled to a decree.

An Approximate Formula for the Weight of Water in a Locomotive Boiler.

BY GEORGE F. SUMMERS.

The following formula will give approximately the weight of two gages of hot water in a locomotive boiler:

Weight in lbs. $= (ad^2 - bt)\,l + cfk$,

where: a = .0227
b = .0991
c = .653 for narrow fire-boxes, say 40 in. wide.
c = .706 for wide fire-boxes, say 75 in. wide.
c = .976 for very wide fire-boxes, say 100 in. wide.
d = the inside diameter in inches of first ring of straight boilers, or the average of the inside diameters of the smallest and largest courses of other types.
t = the number of 2-in. tubes; for other sizes multiply the number by the square of the diameter divided by four.
l = the length in inches of the tubes over the tube-sheets.
f = the length in inches of the fire-box, at the bottom, inside.
k = the depth in inches of the fire-box, at back.

This, as all other simple formulæ for finding weight of water in a boiler, is only approximate and is not intended to take the place of a careful calculation based on the boiler drawing, but is a ready means of forming an opinion as to the weight of water from the specification before the drawings have been laid down.

TECHNICAL.

Manufacturing and Business.

Chilion P. Conger, of Ogdensburg, N. Y., has been appointed General Manager of the McPherson Switch & Frog Co., of Niagara Falls, N. Y.

Edward B. Lathrop, for over 30 years connected officially with the banking interests of Chicago, has been elected Treasurer of the Locomotive Appliance Co., Chicago, effective Jan. 1. 1902.

Taking effect Jan. 1, the Pressed Steel Car Company make the following appointments: George H. Goodell appointed Chief Engineer. Mr. Goodell has been Assistant Chief Engineer for several months past. Prior to this time he was connected with the Northern Pacific Railway as Mechanical Engineer, and has also had experience in various capacities on other railroads. C. E. Moore appointed Auditor. Mr. Moore is an expert accountant, having been employed by both the Carnegie Steel Company and the Philadelphia Company in this capacity. C. H. Judy appointed Superintendent of the McKees Rocks Works. Mr. Judy was formerly with the Pennsylvania Railroad and has been in the employ of the Pressed Steel Car Company as Assistant Superintendent at McKees Rocks for some months. Three vacancies in the Board have been filled by the election of Judge J. H. Reed and T. H. Given, of Pittsburgh, and H. E. Moller, of New York. Judge Reed is the head of the firm of Knox & Reed, of Pittsburgh, and a director in the United States Steel Corporation, and President of the Philadelphia Company of Pittsburgh. Mr. Given is President of the Farmers' Deposit National Bank, Pittsburgh, and a director in other companies. Mr. Moller represents the interests of large stockholders resident in New York.

The Bohn System installed by the White Enamel Refrigerator Co., St. Paul, Minn., was recently specified for 1,950 refrigerator cars ordered by the Santa Fe from the American Car & Foundry Co. It is said that this system is giving satisfaction on the roads where it is used.

J. A. Foley, Superintendent of the Continental Fruit Express Co., has resigned to take charge of the White Enamel Refrigerator Co.'s office, Old Colony Building, Chicago. For a number of years Mr. Foley was a superintendent of the Union Pacific.

B. S. McClellan, foreman of the passenger car shops of the New York Central at West Albany, N. Y., has accepted a position with The O. M. Edwards Company, of Syracuse, N. Y., as traveling representative for the Edwards window fixtures and extension platform trap door fixtures and other railroad devices. Before going to the New York Central Mr. McClellan was foreman of the Illinois Central shops, at New Orleans.

The Pittsburg Friction Draft Gear Co. was incorporated in Philadelphia December 27. Its office is in Pittsburgh, Pa.

Iron and Steel.

James Hicks, of Piqua, Ohio, who was President of the Cincinnati Corrugated Iron Works, and Vice-President of the Piqua Iron Works, later absorbed by the United States Steel Corporation, died in New York City, Dec. 24.

The United Engineering & Foundry Co., of Pennsylvania, was incorporated last week, with a capital stock of $5,500,000. The company has an office in Pittsburgh, Pa., but proposes to build a plant at Youngstown, Ohio.

The Norwalk Steel & Iron Co., of Norwalk, Ohio, was incorporated in Delaware, Dec. 27, to make iron and steel and other metals. The incorporators are: J. E. Condram, Canton, Ohio; E. E. Erickson, Pittsburgh, Pa.; F. Prolzman, Allegheny, Pa. The capital stock is $1,000,000.

According to a despatch from London, Messrs. Guest, Keen & Co., of Dowlais and Cardiff, who recently bought the Dowlais Steel Works at about $10,000,000, have now bought the steel works and collieries of Crawshay Bros., of Merthyr Tydvil, at about $7,500,000.

The United States Steel Corporation is about to make all the heads of departments partners in the business. This announcement was made by Mr. Schwab at a banquet in Chicago last week. The plan is to give all men in active positions an interest in the business. This new system will effect some 300 men.

Richard Garlick has been elected Treasurer of the Youngstown Sheet & Tube Co., Youngstown, Ohio.

Among the recent contracts taken by the American Bridge Co., of New York, are the two bridges for the Wabash Railroad's entrance into Pittsburgh. These bridges are both cantilevers, 1,504 ft. long, with a center span of 812 ft. They carry two tracks and the eye-bars will be the largest ever made in this country, requiring the building of special machinery. One bridge is located over the Allegheny River at Pittsburgh, and the other over the Ohio at Mingo.

The Wm. B. Scaife & Sons Co. has been incorporated under the laws of New Jersey, with a capital stock of $850,000. K. K. McLaren, August S. Meeker and Clifford W. Perkins are the incorporators.

The Algoma Tube Works, Ltd., is incorporated in Canada, with a capital stock of $30,000,000. It is one of the enterprises of F. H. Clergue, and will be located at Sault Ste. Marie. The directors are F. H. Clergue, of Sault Ste. Marie; E. V. Douglas, F. S. Lewis, of Philadelphia, and H. C. Hamilton, of Sault Ste. Marie.

The New Steel Car Works.

The Structural Steel Car Company has been formed in Canton, Ohio, to build and carry on works at that place. Mr. Ellwood C. Jackson, of Wilmington, Del., is the President. Mr. Jackson was born a car builder, being a son of the late Job H. Jackson, and having himself been Secretary and Vice-President of the Jackson & Sharp Company, which plant was sold to the American Car & Foundry Company last spring. The other officers of the new company are: H. A. Cavanah, Vice-President; A. S. Griffin, Secretary and Treasurer; John R. Reed, General Manager; H. H. Woodcock, General Superintendent, and R. H. Hornbrook, Engineer. Mr. Reed, the General Manager, was for 12 years the manager of the Wrought Iron Bridge Works of Canton. The capital stock is $500,000 with the privilege of increasing to $1,000,000, the company having been incorporated in West Virginia. It is proposed to build structural steel freight cars. The company has a convenient tract of 30 acres of land between Fort Wayne and the Wheeling & Lake Erie railroads. It is proposed to start the works about the first of next March with from 400 to 500 men, and a daily capacity of from 20 to 25 cars.

J. G. Brill Company in England.

It is stated that the J. G. Brill Co., who will build a plant in Preston, England, will begin work shortly after the beginning of the new year. The site for the new works is located about 30 miles from Liverpool.

To Make Steel Freight Cars.

The National Rolled Steel Car Co., incorporated a short time ago in West Virginia, is said to be ready to let contracts for its plant, which will be in the vicinity of Pittsburgh. J. D. Carnahan, President of the Company, says that the site for the new works will not be announced for a short time. The company also intends to make car trucks. The capital stock of the company is $1,000,000.

Creosoting Works Burned.

The large creosoting works of the Southern Pacific Co., near Houston, Texas, were destroyed by fire on Dec. 24. It is said that the loss will reach about $100,000, and that no insurance was carried.

New Jersey Water Front Improvements.

The New Jersey Commissioners of Pilotage, in their annual report submitted to the Governor last week, recommend that appropriations aggregating $596,000 for deepening Staten Island Sound, deepening Passaic River and improving Raritan River.

Ghent Canal Improvement.

Bids are wanted for improving the Ghent Canal at Terneuzen. The upset price of the work is about $750,000. A deposit of some $35,000 is required. The Chief Engineer is M. De Heem, Directeur des Ponts et Chaussees, Rue d'Abraham, No. 11 Ghent. The engineer in charge is M. Grenier, Quai des Tonneliers, No. 6, Ghent, Belgium.

Pneumatic Tool Consolidation.

The Chicago Pneumatic Tool Co. was incorporated under the laws of New Jersey on Dec. 28, with a capital of $7,500,000. This is the consolidation frequently mentioned. At present it is proposed to take in the Boyer Machine Co., of Detroit; the Franklin and New York Air Compressor Co.; the Chicago Pneumatic Tool Co., and the Tate-Howard Co., of Manchester, England.

The Battleship "Missouri."

The battleship "Missouri," a sister ship to the "Maine" and the "Ohio," was launched from the yards of the Newport News Ship Building & Dry Dock Co., at Newport News, Va., Dec. 28. The keel was laid Feb. 7, 1900, and she is now over 51 per cent. completed. She is 338 ft. long on the load water line, 72 ft. 2½ in. beam, with a mean draught of 23 ft. 6 in. and 12,500 tons displacement. In her main battery is four 12-in. rifles in two balanced turrets, and 16 6-in. guns; in the secondary battery are 24 small guns. The turrets are turned by electricity, which is also used for lighting, telephone service, to give power to four searchlights and for minor purposes. The "Missouri," has twin-screws, water tube boilers, vertical-cylinder, direct-acting triple-expansion engines, and is designed to make 18 knots an hour. Her contract price was $2,885,000.

Railroad Building in 1901.

In our annual estimate of new railroad build in the United States during the year, printed last week, the figure for Canada was inserted in such a way as to be misleading. The totals given at the foot of the column did not include the Canadian mileage; 4,518 miles is the total for the United States.

New York Rapid Transit.

Mr. Geo. L. Rives, new corporation counsel for New York city, has resigned as a member of the Rapid Transit Commission, and Mr. John Claflin has been elected to succeed him.

First Electric Train On the Manhattan Elevated.

On Monday, Dec. 30, the first electric train of the Manhattan Elevated Railway was run on the Second avenue line with current from the new power plant at Seventy-fifth street and the East River. This may be considered the actual opening of the line with electrical equipment, although no passengers were carried on Monday. This trial train was made up of two motor cars and one trailer. It ran from Sixty-seventh street, at 2:10 p. m., to South Ferry, and from South Ferry to 129th street, arriving at the latter place at 4 p. m. The trips were satisfactorily made, and electric trains will be added and passengers taken in a few days, as fast as the completion of the power house work warrants. In our issue of Dec. 13, 1901, we gave a diagram of the train-makeup as it will be in regular service, relating to motor cars and trailers.

THE SCRAP HEAP.

Notes.

Dining cars, lighted by electricity, are about to be introduced on the Queen & Crescent. Meals will be served by the card.

The Seaboard Air Line has been obliged, in consequence of the scarcity of coal, to fit up some of its locomotives as wood burners. Engines burning wood are now running between Hamlet and Wilmington.

The flood of Dec. 15 interrupted traffic on the Maine Central between Bangor and Portland seven days. The Northern Central, between Elmira, N. Y., and Williamsport, Pa., was open through on Dec. 20, or five days after the flood. The Lehigh Valley, between Ithaca and Elmira, was closed for more than a week. Traffic on the Central of New Jersey was restored Dec. 19.

The trunk lines have agreed that for employees of connecting lines half-fare tickets may be granted, and they may also be issued to properly certified employees of express and telegraph companies operating over the lines and to employees of the Railway Mail Service. Such tickets may be bought also for dependent members of the families of the classes named. This reduction is intended only for cases where an employee is traveling at his own expense.

The agreement which was said to have been reached among important railroads and members of the Interstate Commerce Commission on a bill to authorize pooling of rates, is now said to have fallen through. It is claimed that the Commissioners have concluded to try to get rate-making powers from Congress without granting any concession to the railroads, and that the Pennsylvania Railroad appears to be willing to let the Commissioners pursue this course unhindered.

Officers of the American railroads operating in Mexico have received formal notice that the Mexican Government will enforce the rule which requires the employees of all the railroads operating in Mexico to be able to speak and understand the Spanish language. It is estimated that there are about 1,000 officers and agents of United States railroads now in Mexico. A newspaper item says that "few of these can speak the Spanish language," which sounds like a pretty strong statement. A more reasonable view is that given by a Mexico City paper, which says that Pullman car conductors are the only class that will be much affected by the notice.

The Bessemer & Lake Erie has made an increase, amounting to about ten per cent., in the wages of freight trainmen. Increases, at about this rate, appear to have been decided upon by all of the roads interested in the wages of yard conductors and brakemen at Pittsburgh and Chicago. On the Baltimore & Ohio, some trainmen will also receive an increase. A press despatch says that the increase will average about 8 per cent., and was made without a request from the employees. The most important increase is in the compensation of firemen. The present rate on consolidation engines is 2.125 cents, and the new rate 2.25 cents a mile. On ten wheel engines the rate will be 2.125 cents a mile, an increase of five cents a hundred miles. Rear brakemen have been designated "flagmen," and will be paid ten cents a day more than other brakemen.

Traffic Notes.

The Chicago, Milwaukee & St. Paul has reduced passenger rates on its lines in South Dakota east of the Missouri River from 4 cents a mile to 3 cents.

The Hamburg-American Steamship Company is carrying coal from America to Germany for $1.32 a ton. It is said that large quantities of gas, coking, and anthracite coal have been bought in America by German dealers.

It is stated in Baltimore papers that the Central Elevator Company, which now manages the grain elevators controlled by the Pennsylvania Railroad at Baltimore, has reduced the rate for storage of grain to 7½ mills a bushel for 20 days. The rate hitherto has been 1¼ cents for 10 days.

It is said that all of the railroads in the interchangeable mileage bureau of the Western Passenger Association have agreed to raise the minimum distance which holders of the interchangeable credentials must travel before they can secure a rebate of one cent a mile from 2,000 to 3,000 miles. The new regulation takes effect January 1.

The newspapers of St. Paul and other Northwestern cities say that the Great Northern and the Northern Pacific will soon announce a reduction of freight tariffs, covering the territory between St. Paul and the Pacific Coast, making lower local and through rates. Both roads, it is asserted, will make voluntary reductions in rates, based upon the growth of traffic.

The Michigan Central reduced its rates of fare throughout its main line in Michigan on Dec. 30 to 2 cents a mile as required by the railroad law of the State. This will probably cause a corresponding reduction on competing lines, and is a consequence of the repeal of the special charter of that road, taking effect Dec. 31. The Michigan Central announces the abolition of stop-overs.

Chairman F. C. Donald, of the Central Passenger Association, reports that more than $60,000 worth of tickets were invalidated by the joint agency in Buffalo during the Pan-American Exposition. These were mostly cases of the presentation of return portions of excursion tickets by other than the original purchasers. The total number of tickets stamped and validated by the joint agency in Buffalo between May 1 and Nov. 2, inclusive, was 922,826, a daily average of 4,902 tickets.

Scarcity of freight-cars continues general throughout the country. In the Pittsburg district it is said to be worse than ever before, and many mills are shut down wholly or partly. President Schwab said a few days ago that $3,000,000 worth of finished product was piled up in the yards of the Homestead and Duquesne mills, with no prospect of removal. At Chicago the lack of motive power is said to be the worst difficulty. Engines have been crippled by continuous heavy work and by cold weather. Furnace men complain that the railroads are utterly unable to deliver their coke. It is said that in Virginia a number of plants are shut down. In Alabama coal mines, coke ovens, iron mines and furnaces are all greatly embarrassed. In Chicago and the Northwest about half of the furnaces are idle. Latest reports from the Mahoning and Shenango valleys are that practically all furnaces are stopped.

The Pennsylvania and the Central Railroad of New Jersey have made a few changes in suburban tickets to and from New York. Where the rate for season tickets has been graduated from, say, six dollars the first month in the year to five dollars for the twelfth month, the rate is made uniform for all months. A slight advance is made in the total yearly cost. The monthly ticket will contain sixty coupons. Fifty-trip tickets, heretofore sold good for the bearer, are discontinued; and a fifty-trip family ticket will be sold, good also for visitors and servants. Round trip tickets, good in either direction, have been withdrawn, and hereafter such tickets will be good only in the direction in which they are printed.

The Baltimore & Ohio will hereafter refuse to make concessions to excursion agents on business to points on lines of that company. This appears to indicate that the Baltimore & Ohio will run personally conducted excursions itself, as does the Pennsylvania; and the reporters believe that the whole policy of the Passenger Department of the Baltimore & Ohio is to be made like that of the same department of the Pennsylvania. For the present it is said the Baltimore & Ohio will continue to deal with the tourist agencies on business for points beyond Baltimore & Ohio lines. The Pennsylvania has for many years refused to co-operate with independent tourists agencies. Mr. Boyd says: "In dealing with independent tourist agents irregular methods are encouraged; very low, and in many cases entirely unauthorized railroad fares are used for basing purposes, and the irregularity covered up in a total rate including advertising expenses, hotel accommodations, carriage drives and various other features, with the result that the revenue of the transportation company is sacrificed for the benefit of private enterprise."

I. C. C. Decision On Lumber Rates From Virginia to New York.

The Interstate Commerce Commission, in an opinion by Chairman Knapp, has rendered its decision in the case of the National Wholesale Lumber Dealers' Association vs. the Norfolk & Western and others. Lumber in carloads is shipped from points in West Virginia and Southwestern Virginia to New York City over the N. & W. to Hagerstown, and thence via the Pennsylvania to destination; and over the N. & W. to Shenandoah Junction and thence via the B. & O., under rates made by adding to those of the N. & W. to Hagerstown and Shenandoah Junction a charge of 13 cents per 100 lbs., thence to destination. This 13-cent rate was advanced from 12 cents in 1893, and the N. & W. charges were generally increased in 1899 and 1900 about 1½ cents per 100 lbs. Much lower rates on competing lumber have been and are maintained from neighboring points in the same shipping section to New York by the B. & O. and by the C. & O., connecting with the B. & O. at Staunton and the Pennsylvania at Washington. The N. & W. line is considerably longer than the C. & O., but present rates by the N. & W. yield higher rates per ton per mile than those of the C. & O. line. The rates from N. & W. points to Philadelphia are 6 cents lower than those for the 90 miles greater distance to New York, while on the C. & O. the difference in favor of Philadelphia against New York is only 2 cents. Upon all the facts and circumstances, the Commission holds that the through rates complained of are unreasonable and unlawful, and that there should be an aggregate reduction in the through rates of 2½ cents per 100 lbs.

Passenger Train Burned in a Liverpool Tunnel.

A train on the Liverpool Overhead Railway was set afire by a burnt-out fuse in one of the cars, on Dec. 23, while it was in the tunnel, near Dingle Station, and the flames spread with such great rapidity that six persons were burned to death. It appears that there was a strong current of air blowing through the tunnel, which is about 1,000 ft. long, and the fire was greatly intensified by the burning of a large number of creosoted sleepers which were piled at the side of the track in the tunnel. There were not many passengers in the cars at the time, but there was great confusion, and at first it was reported that over 30 were killed. Many persons were almost suffocated. The tunnel was a blazing furnace for several hours.

Lake Shore Station in Chicago.

The passenger trains of the Lake Shore & Michigan Southern are now running to and from the Grand Central station in Chicago, the Lake Shore station at Van Buren street being abandoned for the purpose of giving a free field to the workmen who are to put up the new station on the site of the old one. The Grand Central is at Harrison street and Fifth avenue, a very short distance southwest of the Lake Shore station.

Mr. Daniels' Views.

The *Buffalo Commercial* reports Mr. George H. Daniels, General Passenger Agent of the New York Central, as follows:

"Electric-road service is a natural product of suburban traffic, and the steam lines do not visibly suffer financial loss. Suburban traffic, as a rule, is an expensive luxury for the steam roads, and they cater to it principally on account of its accommodation for patrons and as a source of advertisement.

"I question if there is a steam road in the country making any money from carrying suburbanites. The Lake Shore out of Chicago and the Pennsylvania out of Philadelphia would very willingly relinquish their suburban trains. The half cent a mile rate given to suburbanites does not pay for the operation of the trains and cost of maintaining expensive terminals."

LOCOMOTIVE BUILDING.

The Atlantic Coast is having four locomotives built at the Baldwin Works.

The Norfolk & Southern is having one engine built at the Baldwin Works.

The Tennessee Copper Co. is having two locomotives built at Schenectady.

The National Steel Co. is having a locomotive built at the Pittsburgh Works.

The Baldwin Locomotive Co. is building five locomotives for different parties.

The Choctaw & Memphis is having two locomotives built at the Baldwin Works.

The Hocking Valley has ordered 15 locomotives from the American Locomotive Co.

The Chicago, Rock Island & Pacific is having 17 locomotives out of the order reported Nov. 22 built at the Brooks Works.

The Louisville & Atlantic has ordered from F. M. Hicks, of the Hicks Locomotive & Car Works, a 45-ton eight-wheel locomotive, with 55-in. boiler, 201 flues, 160 lbs. steam pressure, American equalized brakes, and a 3,500-gal. tank.

The Michigan Central, as reported Dec. 27, has ordered from the American Locomotive Co. 10 Central-Atlantic type locomotives. They will weigh 176,000 lbs., and have 21-in. x 26-in. cylinders; 79-in. driving wheels; straight top boilers with a working steam pressure of 200 lbs. and 396 tubes 2 in. in diam. and 16 ft. long; fire-boxes, 96 in. long and 75⅝ in. wide, and a tender capacity for 5,100 gals. of water and 10 tons of coal. The specifications call for Westinghouse brakes, Gould couplers, Hancock inspirators, U. S. piston and valve rod packings, Leach sanding devices, Detroit and Michigan lubricators and Detroit springs.

CAR BUILDING.

The Illinois Car & Equipment Co. is building 10 freight cars for a private concern.

The Baltimore & Ohio has ordered 3,000 steel cars from the Pressed Steel Car Co.

The American Car & Foundry Co. is building 67 cars of miscellaneous types for various parties.

The Choctaw, Oklahoma & Gulf has ordered 1,200 tank cars from the Mt. Vernon Car Mfg. Co.

The German-American Provision Co. has ordered five new tank cars from F. M. Pease, Chicago.

The Chicago, Burlington & Quincy has ordered five parlor and cafe cars from the Pullman Co.

The Chicago Great Western is reported to have ordered 500 cars from the South Baltimore Car Works.

The Arkansas Southern has ordered 50 box cars of 60,000 lbs. capacity from F. M. Pease, Chicago.

The Palestine-Beaumont Oil & Development Co. has ordered 20 tank cars from F. M. Pease, Chicago.

The Southern Pacific has ordered from the Pullman Co. 40 cars for passenger service in addition to the 18 dining cars.

The Philadelphia & Reading is reported to have ordered 100 refrigerator cars from the American Car & Foundry Co.

The Chesapeake & Ohio is having 200 freight cars built at the Jeffersonville shops of the American Car & Foundry Co.

The San Antonio & Aransas Pass is having 200 freight cars built by the American Car & Foundry Co., at Jeffersonville.

The Louisville, Henderson & St. Louis is having four coaches built at the Jeffersonville Works of the American Car & Foundry Co.

The Cumberland Valley is building four passenger coaches with wide vestibules of the latest pattern, in its Chambersburg shops.

The Seaboard Air Line has ordered 500 box cars from the Southern Car & Foundry Co., instead of the American Car & Foundry Co., as reported last week.

F. M. Pease has ordered 100 tank cars of 60,000 lbs. capacity. They will measure 33 ft. long, 8 ft. 6 in. wide and have Westinghouse brakes and Hein couplers.

The Chicago, Milwaukee & St. Paul will build at its Milwaukee shops 100 ore cars of 100,000 lbs. capacity, and 500 50-ft. furniture cars, in addition to recent orders.

The Portland & Rumford Falls has ordered 100 steel flat cars of 100,000 lbs. capacity, and 25 coal cars of 100,000 lbs. capacity from the Pressed Steel Car Co., of Pittsburgh.

The Great Northern has ordered 150 steel cars of 100,000 lbs. capacity, from the American Car & Foundry Co., in addition to the 350 recently ordered. Also 16 combination baggage and express cars from the same firm.

The Union Coal Tar & Chemical Co. has ordered four tank cars of 80,000 lbs. capacity. They will have Westinghouse brakes, McCord journal boxes, Tower couplers and Illinois Car & Equipment Co.'s standard bolsters.

The Barrett Mfg. Co., Chicago, has ordered 20 tank cars of 80,000 lbs. capacity. They will measure 35 ft. long and have Westinghouse brakes, Chicago couplers, Miner draft rigging, Simplex body and truck bolsters, Griffin wheels and McCord journal boxes.

The Rodger Ballast Car Co. has sold to the Cincinnati, Richmond & Muncie 20 of their new 34-ft. 40-ton convertible ballast gondola and coal cars, and one distributing car. These cars are equipped with air and vertical hook couplers. The equipment has been in use on the C., R. & M. during the past season under rental.

The Louisville & Atlantic has placed an order with F. M. Hicks, of the Hicks Locomotive & Car Works, for three coaches, two of which will be straight passenger with oak interior finish, double chandelier lamps, Miller platforms, Janney couplers, Westinghouse quick-action air-brakes, and four-wheeled steel-tired trucks, and the third will be a combination mail and baggage car 55 ft. long, with the same general specifications.

BRIDGE BUILDING.

ARLINGTON, WASH.—The County Commissioners have decided to build a combination bridge across the river at Arlington at a cost of $12,000.

BAY CITY, MICH.—Contract for the steel bridge over Saginaw River at Cass avenue is let to the King Bridge Co., of Cleveland, Ohio.

BOSTON, MASS.—In his annual report of the Charles River bridges Commissioner Wm. J. Marvin calls attention to the bad condition of Craigie bridge and suggests that a new bridge be built at once. He also suggests a new steel bridge in place of the Boylston street bridge.

The Mayor is considering the petitions to build the proposed Northern avenue bridge over Fort Point Channel to connect the city with the new docks and warehouses in South Boston. This bridge was authorized by the Legislature of last year, subject to the approval of the city government.

The Common Council is considering ordinances appropriating $25,000 to be spent by the Superintendent of Streets for building footbridges over the tracks of the New York, New Haven & Hartford to connect Wellington and Albermarle streets, Northampton and Whitman streets, Claremont Park and Blackwood street, and Greenwich Park and Cumberland street.

BRIDGEPORT, CONN.—The contract for the Scherzer rolling liftbridge over Pequonnock River for the New York, New Haven & Hartford is let to the Pennsylvania Steel Co.

BUFFALO, N. Y.—Bids for the proposed Louisiana street viaduct were opened Dec. 20. The Buffalo Structural Steel Co. bid $114,400, and $105,539, under alternate specifications, which seems to be the lowest bid. Thomas McKeon is the lowest bidder for the substructure, his bid being $82,495.

The Board of Public Works, on Dec. 24, received one bid for building the Scherzer rolling liftbridge over the City Ship Canal at South Michigan street. The bid was by the American Bridge Co., and $65,000.

Bids are wanted, Jan. 7, by the Grade Crossing Commission for the superstructure of a viaduct over the New York, Chicago & St. Louis, the Western New York & Pennsylvania and the Buffalo Creek R. R. in Elk street. Frank V. E. Bardol, Chief Engineer.

CHICAGO, ILL.—The Chicago, Milwaukee & St. Paul R. R. is now receiving bids for some 15 truss spans, varying in length from 130 ft. to 250 ft. Contracts will be placed for these about the first of the year. The company will soon call for bids for a lot of girder spans. The truss bridges above referred to cover eight spans needed on the new line building between Muscatine and Ottumwa called the Kansas City cut-off. Two spans of 160 ft. and one 250 ft. are to replace spans in the bridge over the Mississippi River at La Crosse, Wis. Several of the spans in this bridge are being replaced this winter and these three spans will complete the steel work necessary for the extra length of this long bridge over the Mississippi. One of the spans above referred to is a three-hinge braced arch 210 ft. long to replace the present bridge over the Menominee River at Iron Mountain, Mich.

CLEVELAND, OHIO.—James Ritchie, Engineer of the Grade Crossing Commission, has submitted plans to the Big Four R. R. for the proposed crossings of the tracks at Gordon and Clark avenues. They are for iron bridges over the tracks. Plans for two other bridges are being made for Swiss street and Burton street. These will be undergrade crossings.

Wm. J. Carter, Chief Engineer of the Department of Public Works, writes that he has made preliminary estimates for a viaduct running from Huron street, on the East Side, over the valley and Cuyahoga River, to Lorain street on the West Side. A bill may be introduced at this session of the Legislature to get necessary funds for building. Further than this nothing has been done.

CLINTON, IOWA.—The County Board of Supervisors has decided to build a bridge across Iowa River here.

CUYAHOGA FALLS, OHIO.—The Northern Ohio Traction Co. will build a double-track bridge across Cuyahoga River at the gorge. It will be about 400 ft. long and cost about $50,000.

DANVILLE, ILL.—The report that the contract is let for the Big Four's stone arch bridge over North Branch at Danville, is erroneous. It will, however, be let soon after the first of the year. (Dec. 6, 1901, p. 846.)

DENISON, IOWA.—The Board of Supervisors want bids, Jan. 1, for all bridge work in 1902. M. J. Collins, County Auditor.

DOYLESTOWN, PA.—The Doylestown & Easton Trolley Co. proposes to build a new bridge over the Durham Creek on the river road.

DULUTH, MINN.—Plans are being considered to do away with all wooden bridges between the center of the city and West Duluth. Many will be replaced with steel.

EXETER, N. H.—The Seabrook & Hampton Beach St. R. R. Co., and the Grantie Land Co. proposes to build a bridge across the Hampton River.

FAYETTE, MISS.—Bids are wanted, Feb. 3, by the County Commissioners for a steel bridge over Coler Creek.

FREDERICTON, N. B.—The Department of Public Works will soon want bids for building bridges at Emerson Creek, Mallory, Osborne and South Pisarino in St. John County.

HANNIBAL, MO.—The Hannibal Ry. & Electric Co., of Hannibal, has a petition before the Councils for permission to build a bridge over Bear Creek near Main street.

HOUSTON, TEXAS.—The City Engineer is authorized to prepare plans and specifications for an iron bridge across Buffalo Bayou at the foot of Sixth and Smith streets.

See Houston & Texas Central under Railroad Construction. See also Southern Pacific.

IOWA CITY, IOWA.—The Board of Supervisors of Johnson County has contracted with the American Bridge Co. for the new bridge over Iowa River here.

JOPLIN, MO.—Three bridges are proposed at a total cost of $13,700.

KANSAS CITY, MO.—It is probable that the contract for the new bridge over Missouri River on the site of the old Winner bridge for Theodore C. Bates, of the Union Bridge & Terminal Co., will soon be let. It is stated the American Bridge Co. has submitted a proposition to the Terminal Co.

LA CROSSE, WIS.—See Chicago, Ill.

LAFAYETTE, IND.—The County Council has approved an appropriation of $31,000 for a bridge over Wabash River at Brown street, to replace the old wooden structure. Bids will be received at the January meeting of the Commissioners. The bridge will be about 582 ft. long. The plans are ready.

LANSING, MICH.—Bids are wanted, Jan. 27, by C. J. McCullough, for the steel bridge over Grand River at Washington street. The estimated cost is between $30,000 and $50,000. H. A. Collar, City Engineer.

LEBANON, IND.—David H. Shockley, Auditor of Boone County, will receive bids, on Jan. 7, for building a number of steel bridges and several stone arches. The drawings and specifications are on file with the Auditor.

LOCK HAVEN, PA.—Viewers have decided upon a site for the proposed bridge over the river at or near Pine.

MORGANTOWN, W. VA.—A bill is before Congress authorizing the Central Railroad of West Virginia to build a bridge across the Monongahela River at Morgantown.

OTTAWA, ONT.—The City Council is reported considering building a drawbridge at Elgin street over the Rideau Canal.

PALMYRA, N. Y.—The Ontario & Wyoming Traction Co. will bridge the Erie Canal in this village.

PEMBINA, N. DAK.—Report says that the County Commissioners want bids, Jan. 9, for four bridges.

PERTH AMBOY, N. J.—An electric railroad company, in which Senator Keen and Governor Voorhees are interested, according to report, will build a bridge over Raritan River.

PORTLAND, ORE.—The City & Suburban Ry., according to report, will build a bridge over Sullivan's Gulch.

PRAIRIE DU CHIEN, WIS.—It is stated that the Chicago, Milwaukee & St. Paul is preparing to build a new bridge over the Mississippi River here.

PROVEMONT, MICH.—Bids are being received by Wm. Douglas for a steel bridge about 250 ft. long over the narrows of Carp River for the Manistee & Northeastern R. R. J. J. Hubbell, Chief Engineer, Manistee, Mich.

ROME, ITALY.—The Minister of Public Works at Rome is reported advertising for bids for a three-span bridge over River Volturno, Caserto, Italy.

SCHENECTADY, N. Y.—Officers of the New York Central, the Delaware & Hudson, the General Electric Co., and the American Locomotive Co., are considering with the city officers, plans to eliminate the grade crossings in Schenectady.

SIOUX FALLS, S. DAK.—Bids are wanted, Jan. 9, for a 160-ft. steel bridge at Railroad street. C. A. Grinde, County Auditor.

SPRINGFIELD, MASS.—A committee in charge of the St. James avenue bridge has reported to the City Council, stating what has been planned for a bridge, and the Mayor is authorized to sign an agreement with the New York, New Haven & Hartford.

VERMILLION, OHIO.—The Lake Shore Electric Ry. Co., Cleveland, Ohio, we are told, is considering building a bridge over Vermillion River, but no decision has been arrived at. The probable cost will be $10,000.

WELLAND, ONT.—The County Council has authorized the Roads & Bridge Committee to get plans for a steel draw-bridge over Welland Canal at Montrose.

WELLSBURG, OHIO.—The contract for the substructure for the large bridge over the Ohio River at Mingo Island for the Wabash R. R. is yet to be placed. The contract for the steel work is let to the American Bridge Co.

WESTFIELD, MASS.—A hearing will be given, Jan. 18, on the proposed raising of the Boston & Albany viaduct on North Elm street. The question of changing the Pochassic street bridge and the bridge over Westfield River will be considered later.

WILLIAMSPORT, PA.—The City Engineer is reported making plans and specifications for a new bridge over Lycoming Creek to replace one destroyed last week.

Other Structures.

ALTOONA, PA.—The Pennsylvania Railroad, according to report, will enlarge its shops at Altoona and build a wheel foundry on land recently bought on Sixteenth street.

BRISTOL, VA.—The Southern Ry., according to report, will build a joint station with the Norfolk & Western in Bristol.

CHESTER, PA.—The Chester Iron & Steel Co., according to report, will change its muck mill into a rail mill. Work is progressing on the improvements to its angle department, and it is expected it will be in operation soon.

EL PASO, TEXAS.—Mr. Kruttschnitt, of the Southern Pacific, is reported as saying that it is the intention of the company to enlarge the car shops at this place five times their present capacity. Other improvements at this place are completed.

ELIZABETHTON, TENN.—Chas. P. Tonoray and Geo. E. Boren are reported negotiating to build a steel plant at Elizabethton.

FORT WAYNE, IND.—The Fort Wayne Electric Works, according to report, will build a 55 x 33 ft. addition to its plant. E. A. Barnes, Superintendent.

GRAND RAPIDS, MICH.—The Grand Rapids, Kalamazoo & South Haven Traction Co. will build a power station near Allegan and dam the Kalamazoo River, and will soon let contracts. M. Van Harlingen.

HILLSBORO, TEXAS.—The Missouri, Kansas & Texas will build a three-story freight office building at a cost of $10,000.

HOUSTON, TEXAS.—See Houston & Texas Central, also Southern Pacific under Railroad Construction.

KENT, WASH.—The Seattle-Tacoma Interurban Ry. Co. will build shops and office building in Kent on land given by citizens of this town.

KEYSTONE, S. DAK.—The Burlington Railroad, according to report, will make numerous changes in this town and build a new passenger station.

KINGSLAND, N. J.—The carpenter shop of the Lackawanna R. R. at this place was burned on Dec. 23.

LIVINGSTONE, MONT.—The Northern Pacific is reported to have let a contract for a new station at Livingstone to cost $75,000.

MARSHALLTOWN, IOWA.—The Chicago Great Western has announced that it will build a new depot in Marshalltown next spring. The estimated cost is $40,000. Other improvements will be made at the same time.

MANKATO, MINN.—The Chicago, Milwaukee & St. Paul has plans ready for a new depot in this city.

PEORIA, ILL.—The Peoria & Pekin Union is reported having plans made for a 90-ft. addition to each of its freight houses in Peoria.

PITTSBURGH, PA.—The Pittsburgh Works of the American Locomotive Co. are to be enlarged.

PROVIDENCE, R. I.—The New York, New Haven & Hartford contemplates building a new passenger station at Fox Point, facing India street, south of Main street.

RICHMOND, IND.—The American Bridge Co. has contracted for the train shed of the Pittsburgh, Cincinnati, Chicago & St. Louis station in Richmond. The shed will be 65 ft. wide and about 800 ft. long.

RUTLAND, VT.—An officer of the Rutland writes that a new station will be built at Rutland and that the station facilities at Bellows Falls will be improved, as will also the stations at North Bennington and Burlington. Also

some changes will be made in the yards and shops at Rutland, but just what these will be has not been fully determined.

SAN AUGUSTINE, TEXAS.—A public meeting was held last week to consider a site for the proposed railroad depot.

SHARON, PA.—It is announced that the National Steel Co. will build another large furnace at its plant in this city. Other improvements will also be made.

SYRACUSE, N. Y.—The Hyle Bros. Steel Co. has been incorporated with $50,000 capital stock and will build a plant in Syracuse. James S. Gordon and Karl Reynolds, of Syracuse, are interested.

WICHITA, KAN.—The Wichita Bridge Co. has submitted a proposition to the County Commissioners that the county contract with them for all bridge building for three years, in consideration that a bridge plant be built in Wichita.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. A. H. Moore, Secretary of the Reading, died Dec. 24. He was born at Philadelphia, Pa., Jan. 21, 1871.

—Mr. George A. Coe, for a number of years Division Superintendent of the Chicago & Erie, and later Superintendent of Transportation, died Dec. 26, at Chicago, Ill. Mr. Coe began his career as a telegraph operator on the Lake Shore & Michigan Southern.

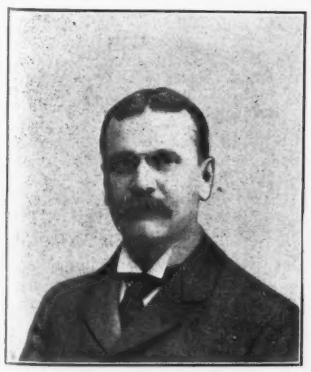
—Mr. John W. Taylor, Chief Engineer of the Terminal Railroad Association of St. Louis, was instantly killed, Dec. 26, by a Wabash switch engine, after jumping from a moving motor car which threatened to run into the switch engine at the May street crossing. Mr. Taylor was born Dec. 9, 1866, at Decatur, Ill., and was a graduate of the University of Illinois. He was at one time Engineer of Maintenance of Way of the St. Louis Merchants' Bridge Terminal Railway, and became Chief Engineer of the company he was with at the time of his death, June 1, 1900.

—Mr. C. E. Dafoe, Superintendent of the Chicago Great Western, is a native of Canada, having been born at Aultsville, Ont., in 1859. His railroad career dates from 1878, when he began on the Grand Trunk as an operator. In 1883 he became associated with the Minneapolis & St. Louis as a clerk, later being promoted to the positions of Train Despatcher, Chief Train Despatcher and Trainmaster. Mr. Dafoe resigned from the last-named position in July, 1900, to take a similar one with the Chicago Great Western, and, on Dec. 1 last, was appointed Superintendent of the Wisconsin, Minnesota & Pacific Division.

—Col. Garrett J. Lydecker, Corps of Engineers, U. S. Army, has been detached from duty at Detroit, Mich., and ordered to Cincinnati, Ohio, to relieve Lieut.-Col. Thomas H. Hanbury as Division Engineer, and also to relieve Major William H. Bixby, of the works, in his charge and to assume the duties of Engineer of the Fourteenth Lighthouse District. Lieut.-Col. Hanbury will proceed to San Francisco, Cal., to relieve Lieut.-Col. C. E. L. Davis, of river and harbor work and as Engineer of the Twelfth Lighthouse District. Lieut.-Col. Davis will proceed to Manila, P. I., for duty on the staff of the General Commanding the Division of the Philippines, relieving Major Clinton B. Sears, who has been assigned to the command of the Second Battalion of Engineers now serving in the Philippines. Major William H. Bixby will proceed to Detroit to succeed Col. Lydecker.

—The General Superintendent of Transportation of the Baltimore & Ohio, Mr. J. C. Stuart, was promoted to this position from that of General Superintendent of the Trans-Ohio Lines. Mr. Stuart was for eight years on the Chicago, St. Paul, Minneapolis & Omaha and the Chicago & North Western, and then (in 1888) was made Chief Train Despatcher of the Chicago & Northwestern. He then became Assistant Superintendent of the West Division and finally Superintendent of the Galena Division. In 1898 he was appointed General Superintendent of the Chicago, St. Paul, Minneapolis & Omaha, which position he held until March 1, 1900, when he became General Superintendent of the Middle and Northwestern Division of the Baltimore & Ohio.

—Mr. Edward B. Taylor, General Superintendent of Transportation, Pennsylvania Lines West of Pittsburgh, has been elected Fourth Vice-President of the Pennsylvania Company to fill the vacancy consequent on promotions following the death of Mr. Brooks. Mr. Taylor was born at Riverton, N. J., Feb. 6, 1850. He was graduated from Haverford College in 1869, and as a civil engineer from the Polytechnic College, Pa., in 1870. He at once entered railroad service, in which he has been engaged ever since and always on the Pennsylvania System. Until 1879 he was on the engineering and maintenance of way staff. Then he became Superintendent of the Lewiston Division and has been an operating officer ever since. April 1, 1888, he became General Superintendent of the Northwest System and March 1, 1890, General Superintendent of Transportation, which office he held until his promotion to the Fourth Vice-Presidency.



ELECTIONS AND APPOINTMENTS.

Ann Arbor.—H. W. Ashley, General Manager, has resigned.

Atchison, Topeka & Santa Fe.—F. J. Easley has been appointed Division Superintendent, with headquarters at Newton, Kan., succeeding Avery Turner.

Baltimore & Ohio.—The following division limits and designations took effect Jan. 1: Pittsburgh Division: The line from Connellsville, exclusive, to New Castle Junction, exclusive, and from Glenwood to Wheeling, exclusive, and branches, with headquarters in Pittsburgh, Pa. New Castle Division: The line from New Castle Junction, inclusive, to Chicago Junction, exclusive, and from De Forest Junction to Fairport, and branches, with headquarters in New Castle, Pa. Cleveland Division: The lines known as the Cleveland Terminal & Valley, and the Cleveland, Loraln & Wheeling, with headquarters in Cleveland, Ohio. Newark Division: The line from Bellaire, Ohio, inclusive, to Midland City, Ohio, inclusive, Shawnee to Sandusky, exclusive of Chicago Junction Yards, Zanesville to Marietta, and branches, with headquarters in Newark, Ohio. The Ohio & Little Kanawha Railroad will be operated as part of this Division. The Chicago Junction Yards are hereby attached to the Chicago Division. H. O. Dunkle has been appointed Superintendent of the New Castle Division, and J. T. Johnson becomes Superintendent of the Cleveland Division.

The following Division Engineers have been appointed: G. B. Owen, Division Engineer of the Pittsburgh Division; E. P. Mobley, of the Philadelphia Division; J. L. Crider, of the Baltimore Division, and A. M. Sprigg, of the New Castle Division.

Baltimore & Ohio Southwestern.—F. D. Gildersleeve has been appointed Assistant General Passenger Agent.

Bangor & Aroostook.—G. M. Houghton, heretofore General Passenger Agent, has been appointed Traffic Manager.

Chesapeake & Ohio.—C. C. Walker, heretofore General Superintendent, has been appointed Superintendent of Transportation. General Superintendent J. M. Gill has resigned on account of ill health and the position has been abolished. F. W. Scarborough, Engineer of Bridges and Buildings, becomes Engineer Maintenance of Way. F. I. Cabell, heretofore Engineer Maintenance of Way, is made Engineer of Construction.

Chicago, Burlington & Quincy.—O. E. Stewart has been appointed Superintendent of the Creston Division, with headquarters at Creston, succeeding H. S. Storrs, resigned. G. W. Fabens, heretofore Trainmaster, becomes Superintendent of the Ottumwa Division, at Ottumwa, succeeding Mr. Stewart.

Cleveland, Cincinnati, Chicago & St. Louis.—The jurisdiction of H. F. Houghton, Division Superintendent at Indianapolis, has been extended over the White Water Division, and B. F. Sipp, heretofore Superintendent of this division, becomes (temporarily) General Agent at Connersville, Ind.

Delaware & Hudson.—J. R. Slack, heretofore Assistant Superintendent of Motive Power, has been appointed Superintendent of Motive Power. James Mac Martin, heretofore Assistant Engineer, becomes Chief Engineer. The office and title of Car Accountant has been abolished and George A. Keller becomes Superintendent of Car Service. All effective Jan. 1.

Delaware, Lackawanna & Western.—A. B. Wallace has been appointed Assistant General Freight Agent, and George W. Hayler becomes Assistant General Passenger Agent. Both with headquarters at New York City.

Denver & Rio Grande.—F. S. Harris having been transferred, the office of Assistant Superintendent, First Division, has been abolished. J. L. Gogerty has been appointed Superintendent of the Pueblo and Bessemer Terminals, with headquarters at Pueblo, Colo.

Erie.—M. B. Hunt has been appointed Mechanical Engineer, with headquarters at Susquehanna, Pa., succeeding Theo. H. Curtis, resigned. (See Louisville & Nashville.)

Grand Trunk.—Charles M. Hays, on Jan. 1, assumed the duties of Second Vice-President and General Manager, succeeding Mr. Reeve, resigned.

Houston East & West Texas.—F. B. Goodrich, heretofore Chief Engineer, has been appointed Manager.

Illinois Central.—C. C. Robinson, Division Master Mechanic, with headquarters at Mattoon, Ill., has resigned.

Louisville & Nashville.—Theo. H. Curtis, heretofore Mechanical Engineer of the Erie, has been appointed Mechanical Engineer of the L. & N., with headquarters at Louisville, Ky., effective Jan. 1.

New York, New Haven & Hartford.—Augustus S. May has been appointed Assistant Treasurer.

Pennsylvania.—At a special meeting held Dec. 30, two new offices were created. One is "Resident Assistant to the President," at Pittsburgh. Robert Pitcairn, heretofore general agent and for a great many years Superintendent of the Pittsburgh Division, was appointed to this position. The second new office is "General Superintendent of the Pittsburgh Terminals." He will have general supervision over the movement of traffic interchanged between the various lines in the Pennsylvania Railroad System and between the lines of the Pennsylvania Western System centering at Pittsburgh. Robert M. Patterson, heretofore Superintendent of the New York Division, has been appointed General Superintendent of Pittsburgh Terminals. R. L. O'Donnel, Assistant Superintendent of the Pittsburgh Division, succeeds Mr. Pitcairn, and R. T. Morrow succeeds Mr. O'Donnel, all to take effect Jan. 1.

Pennsylvania Company.—At a meeting, held Dec. 27, E. B. Taylor, heretofore General Superintendent of Transportation, was elected Fourth Vice-President; Joseph Wood, heretofore Third Vice-President, becomes Second Vice-President, succeeding the late J. T. Brooks, and Mr. Wood, in turn, is succeeded by J. J. Turner, formerly Fourth Vice-President. W. C. Cushing, Division Superintendent at Pittsburgh (Southwest System) becomes Superintendent of the Eastern Division of the Pittsburgh, Fort Wayne & Chicago, with headquarters at Allegheny City, Pa.

Southern.—Brooks Morgan has been appointed Assistant General Passenger Agent, with headquarters at Washington, D. C., effective Jan. 1.

Southern Pacific.—R. W. Knox has been appointed Chief Surgeon of the Atlantic System, with headquarters at Houston, Texas. The position of Medical Director has been abolished.

Texas Central.—The office of Superintendent of Transportation has been abolished and R. M. Cox becomes Superintendent. N. L. Smitham, heretofore Master Mechanic of the Texas Midland, has been appointed Master Mechanic of the T. C., succeeding D. J. Timlin, resigned, effective Jan. 1.

Union Pacific.—H. W. Sheridan, heretofore Trainmaster, has been appointed Assistant Superintendent.

Vandalia Line.—On Dec. 31, the Logansport & Toledo Railway took possession of the railway extending from Logansport, Ind., to Butler, Ind. The general organization of these lines in all departments is extended over the L. & T. W. S. Roney, Auditor, and R. B. Thompson, Treasurer, for the Receiver, will be known respectively as Assistant Auditor and Assistant Treasurer of the L. & T. In all other cases the titles and duties of officers, agents and employees remain the same.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALGER-SULLIVAN LUMBER COMPANY.—An officer writes that 21 miles of railroad have been laid by this company during the past year from a point about two miles south of Flomaton, crossing the Pensacola Division of the Louisville & Nashville, and running in a northwestern direction into the company's timber land in Alabama, two miles of road being in Florida, with two miles of siding additional and 19 miles in Alabama. The company did its own work.

ARKANSAS ROADS.—It is said that the Wisconsin & Arkansas Lumber Co.'s railroad, now building, will be extended 15 miles towards Princeton, Ark., and continued later on to a junction with the Eagle Mill, the northern terminus of which is at present eight miles below Princton.

BALLSTON TERMINAL ELECTRIC.—This company has recently issued a prospectus showing plans for extension to Saratoga, Boston, Lake, Corinth, Hadley, Galway, Amsterdam, Johnstown, Gloversville and other New York towns. The stockholders have authorized an issue of $1,200,000 first mortgage 35-year 5 per cent. gold bonds, of which $800,000 are to be issued at once at par. $385,000 of this amount is to retire the first issue of bonds of the Ballston R. R., which amounted to $250,000, paying the floating indebtedness and improving the road. The remaining $415,000 is to be applied to the Amsterdam extension and the $400,000 retained in the treasury is to cover the cost of future building to Johnstown and Gloversville. The bonds are secured by a first mortgage to the Atlanta Trust Co., of New York, trustee, covering all the present property of the company, with franchises and equipment. (June 28, p. 473.)

BRADY'S BEND & PITTSBURGH.—It is said that surveys are to be made at once for a new railroad eight miles long in Butler County, Pa., to run from Brady's Bend to a point on the Pittsburgh & Western between Karns City and Chicora. The new railroad is designed to open up coal and mineral territory.

CANADA WESTERN.—Application has been made by N. W. Rowell, of Toronto, for incorporation of a railroad to be known as the Canada Western, and to run from Rat Portage to Port Nelson, on Hudson Bay. This is what is known as the Rainy River District, a part of the country which is extraordinarily full of lakes and rivers, and the total distance projected to a final terminus at or near the confluence of the Winnipeg and English rivers on the Western boundary of the Province of Ontario, would be at least 160 miles.

CANADIAN NORTHERN.—Notice is given that this company will apply to the Canadian Parliament at its next session for an act empowering the following extensions to be built:

1. From a point on the line between Port Arthur and Fort Frances; thence northeasterly and southeasterly to the City of Quebec; and from points from this line to Port Arthur, Ottawa and Montreal.
2. From a point on the line at or near McCreary Station, Manitoba, to the southerly boundary of Manitoba.
3. From a point on the line near the Narrows of Lake Manitoba, to a point between Edmonton and the Yellow Head Pass.
4. From a point on the line near Swan River to the Pacific Coast, at or near Skeena River, by way of the Pine River Pass.
5. From a point on the line east of Edmonton in Alberta or Saskatchewan, to the Red Deer River.
6. From a point on the line near Hanging Hide River (Saskatchewan), to the mouth of the Carrot River, near Pas Mission.

CANADIAN PACIFIC.—An officer writes that 36 miles of track have been laid during the past year in Manitoba and British Columbia, and that work is now in progress on the following projects: Between Forrest and Lenore, Man., 42 miles; from Waskada to Westwood, 20 miles; from Snowflake to Mowbray, Man., 12 miles; from West Selkirk to Winnipeg Beach, Man., 26 miles; from Wellwood to Brookdale, Man., 10 miles, and from Laredo, B. C., to Twin Falls, 33 miles. Lines are also under survey to Moosemin, 90 miles, in Assiniboia, N. W. T., and to Glenboro, Man., a distance of 83 miles.

Contract has been let to J. W. Stewart, of Winnipeg, Man., for lowering some of the steeper grades on the main line through the Rocky Mountains at an estimated cost of $1,000,000.

CHICAGO & NORTH WESTERN.—An officer writes that the total amount of track laid by this company during the past year has been 221.24 miles, divided as follows: Between Moville and Sergeant's Bluff, 20 miles; between Nelson and Peoria, 82.9 miles; between Pelican and Crandon, Wis., 17.9 miles; between Princeton and Marshfield, Wis., 85.7 miles, with branches bringing the total mileage of this extension to 100.4. The only line now under contract is the one between Marshall and Evan, Minn., 45.8 miles, which is being built by Winston Bros., of Minneapolis, and D. D. Streeter, of Chicago, and is now graded for the entire distance.

CHICAGO, BURLINGTON & QUINCY.—It is reported that this company will build an extension from Greenfield, the county seat of Adair County, Iowa, to Winterset, the county seat of Madison County, a distance of 28 miles, during the coming year. This extension would pass through a section of country devoid of railroads and would give the city of Winterset an outlet to the western and southern portion of Iowa.

CHICAGO GREAT WESTERN.—It is announced that 100 miles of the line is to be double-tracked next spring between St. Paul, Minn., and Randolph. Second track is also to be laid from Dubuque east for 40 miles in three directions to Oelwein, Iowa, and out of Chicago. Work is to begin as soon as mild weather sets in in the spring.

CHICAGO, ROCK ISLAND & PACIFIC.—It is reported that the extension to El Paso, Texas, will be opened for business at once. A new 30-mile road to develop the Dawson coal fields is being built in connection with this line and is to be opened next May. (Sept. 27, p. 675.)

COLUSA & LAKE.—At a recent meeting of the directors of this company, which is now in operation between Colusa and Sites, Cal., 22 miles, it was voted to make

surveys with a view to extending the line to Bear Valley and beyond that point at a later date. W. P. Harrington, of Colusa, Cal., is President.

DELAWARE, LACKAWANNA & WESTERN.—The Newark Board of Works passed, on Dec. 20, an ordinance providing for the alteration of this company's tracks in Newark. This is in the form of a contract with the railroad, in accordance with which out of a total cost of about $2,500,000, the city will pay $600,000, and assume the expense of altering the street. Work is to begin early this year and it is said that all grade crossings will be abolished between Passaic River and East Orange.

DULUTH, VIRGINIA & RAINY LAKE.—An officer writes that 20 miles were laid on this line in Minnesota this year, and that 80 more, carrying it as far as Koochiching, which is 100 miles from Virginia, Minn., have been let to the Minnesota Land & Construction Co.

ERIE.—Announcement is made that the entire block in New York City, bounded by Eleventh and Thirteenth avenues, Twenty-eighth and Twenty-ninth streets, has been secured by purchase and lease as a freight yard. An auxiliary corporation known as the Erie Land & Improvement Co. has acted for the railroad in managing the deal

HAMILTON, GRIMSBY & BEAMSVILLE ELECTRIC.—This electric line in Ontario has obtained an extension of its powers and now proposes to build the 12 intervening miles between Beamsville and St. Catharines, which will complete the chain of electric lines between Hamilton, Ont., and Buffalo, N. Y.

HOUSTON & TEXAS CENTRAL.—A detailed statement of proposed expenditure during the present year on this company's lines has been filed with the Railroad Commission, and includes 12,500 tons of 80-lb. rails, 64 switches, 70,000 cypress cross ties over and above the usual annual requirement, 50,000 burnettized cross ties beyond the usual requirements, new bridge over Pin Oak Creek to cost $25,000, four new passenger stations, all of them small with the exception of one at Austin to cost $20,000, two new freight stations and a large transfer shed, and three new water stations. To this account is also added the cost of engineering work in locating the new line between Burnet and Lampasas, 24 miles.

INDIANAPOLIS, NASHVILLE & SOUTHERN.—This company was incorporated in Indiana, Dec. 23, with a capital of $200,000, by F. A. Gentle, G. B. Martin and B. F. Nysewander. It is proposed to build a railroad 38 miles long from Indianapolis south to Nashville, Ind., which is the county seat of Brown County, and has at present no railroad connections.

INTERNATIONAL & GREAT NORTHERN.—Contract for building the extension from Waco, Texas, 90 miles north to Fort Worth has been awarded to Hugh Burns, of Taylor, Texas, and work is to begin at once. A branch line is also to be built from Waxahachie to Dallas, a distance of 30 miles, if the right of way between the two places and depot grounds at Dallas are given the company. (Construction Supplement, Oct. 11, 1901.)

IOWA ROADS.—The citizens of College Springs, Page County, Iowa, are planning to build a railroad to Coin, on the Omaha & St. Louis Division of the Wabash, eight miles distant. The town has no railroad connections at present and this spur line is to be built by private capital, a large share of which has already been subscribed.

KINSTON & CAROLINA.—Application has been made in North Carolina for incorporation of a line 60 miles long to run from Kinston through Duplin, Lenoir and Pender counties to a connection with the Wilmington & Weldon branch of the Atlantic Coast Line. The directors are W. C. Swift, H. Tull, J. L. Chapman and others.

MARION & RYE VALLEY.—Surveys are reported for an extension from Currin Valley to Rye Valley, a distance of 10 miles. The line is at present in operation between Marion and Currin Valley, 6½ miles, and has recently been bought by outside parties. The road, when extended, will reach considerable deposits of iron and a timber country. Edward L. Stone, of Roanoke, Va., is President.

MATANE & GASPE.—Application is being made to the Quebec Legislature for incorporation of a line to run from a point near St. Octave de Metis, Que., to Gaspe Basin, by way of Matane, to connect with the Atlantic, Quebec & Occidental, and to build several branches. The incorporators are Prefontaine Bros., Francis Parent and others. The total distance projected is almost 200 miles in an easterly direction.

MERIDA-PETO.—An officer writes that this company has laid 60 miles of track during the past year in Mexico on three branches.

MEXICAN CENTRAL.—An officer writes that 120 miles of track has been laid on this company's lines during the past year as follows: Zapotlan Extension, from a point near Valencia, passing through Santa Ana, Acatlan, Zacoalco, Sayula, Zapotlan, Zapotiltic to Tuxpan; Parral Extension to Rosario; Rio Verde Branch from San Bartolo to Rio Verde River.

MINNESOTA ROADS.—Returns received from the State Railroad & Warehouse Commission too late for publication in our estimate of mileage which appeared last week, show that 200 miles of track have been laid in the State during the year instead of 175 as we estimated. The total mileage of the State, reported for the current year, is 7,074 operated by 31 companies.

MISSOURI, KANSAS & TEXAS.—This company filed a charter at Guthrie, Okla. T., Dec. 23, to build three extensions in Oklahoma and Indian Territory. The main line will run between Guthrie and Stevens, Ind. T., 135 miles, with branches from Oklahoma City to this line, 35 miles, and from the main line to a junction with the line at Wybark, Ind. T., 80 miles. The estimated cost of these three extensions is $10,000,000.

MOBILE & OHIO.—Contract is reported let to W. J. Oliver & Co., of Savannah, for a branch from Searles, Ala., into the northern part of Tuscaloosa County, where there are coal fields. It is said that work will begin at once. (Construction Supplement, Oct. 11, 1901.)

NEW BRUNSWICK COAL & RY.—At a meeting of the directors held in St. John, N. B., Dec. 19, it was decided to ask tenders for building 30 miles of new road from New Castle to Fredericton, N. B.

OCMULGEE & RED BLUFF.—Charter has been granted this company, with a capital of $200,000, to build a railroad from Fitzgerald, on the Seaboard Air Line, Ga., to Red Bluff, on the line of the Southern, 43 miles, in an easterly direction.

ORANGE & NORTHWESTERN.—This new line in Texas has been accepted from the contractors and operation begun. The directors are also reported to have authorized the Chief Engineer to secure an amendment to the charter to permit of extension from South Orange north through the counties of Jasper, Newton, Sabine, Shelby, Panola and Harrison to Marshall, and northwest through the counties of Hardin, Tyler, Trinity, Houston, Leon, Freestone and Navarro to Corsicana, a distance of 125 miles.

PACIFIC NORTHERN & OMINECA.—The surveying parties have completed their work for this season which was to determine the most favorable route for a railroad from tidewater at the head of Kitimaat Arm, B. C., to Hazleton. They have located the route for a distance of 82 miles, and plans are to be prepared this coming winter in order that work may be pushed in the spring.

PARRAL & DURANGO.—An officer writes that 16 miles of this line has been completed in Mexico during the past year, five of which is in the State of Chihuahua between Agua Caliente and Los Puentes, and 11 in the State of Durango, between the Chihuahua boundary and Ojito. This completes the plans of the builders for the present, and no further work is under contract or projected. Samuel E. Gill, of the Hidalgo Mining Co., Pittsburgh, Pa., is President. (Construction Supplement, Oct. 11, 1901.)

PENNSBORO & HARRISVILLE.—An officer writes that surveys are completed for an extension from Harrisville, by way of Rock Camp, to Pullman, W. Va. Contracts are to be let some time this month and work is to begin next spring. The route surveyed gives maximum grades of 2 per cent., a maximum curve of 10 deg. The work involves one steel bridge 60 ft. long. The company intends to use the same rolling stock that is now in use on the part of the road at present in operation and will sell new securities to meet the expense of the extension.

RED RIVER, TEXAS & SOUTHERN.—This company has amended its charter for the purpose of establishing its general headquarters at Fort Worth, Texas, and to build a railroad from the Red River, near Wills, in Grayson County, Texas, through Fort Worth to a point five miles south to form a connection with the Fort Worth & Rio Grande.

ST. LOUIS & SAN FRANCISCO.—An officer writes that the new mileage acquired during the year by means of stock ownership and now building is as follows: In the State of Missouri, 306 by stock ownership and 149 built; Kansas, 258 by stock ownership and 106 built; Arkansas, 212 by stock ownership and 34 built; Indian Territory, 12 by stock ownership and 24 built; Oklahoma Territory, two miles built; Texas, 141 by stock ownership and 100 built and building; Tennessee, 17 by stock ownership; Mississippi, 143 by stock ownership, and Alabama, 182 by stock ownership.

The line between Sherman, Texas, and Carrollton was reported finished Dec. 20, and the belt line connecting with the Fort Worth & Rio Grande is to be opened Jan. 15. (Nov. 22, p. 816.)

SAN FRANCISCO & PIEDMONT.—Articles of incorporation have been filed in California by a company which proposes to run an opposition ferry system between Oakland and San Francisco, including an electric tunnel railroad with its terminus near Goat Island. The directors are all directors of the Realty Syndicate, which owns the Oakland Transit Co., and the Oakland street car lines on the Oakland Side of the bay. They are F. M. Smith, F. C. Havens, W. H. Martin, E. A. Heron and W. F. Kelly. The purpose of the new corporation, as stated in the articles, is to build an underground road to commence at a point on the line of its proposed road at or near the pier head line in Emeryville, and to run to a point near the Island of Yerba Buena. The estimated length of the road is 17 miles, and the capital stock is $2,500,000, with $100,000 paid up.

SHASTA MINERAL BELT.—This company has been incorporated in California by D. P. Doak, of St. Louis, and several California parties. The capital stock is $1,000,000, and it is proposed to build a line in Shasta County, Cal.

SOUTH & WESTERN.—A company has been incorporated in North Carolina under the above title, with powers to build a railroad from Southport or Wilmington, N. C., to the Atlantic Ocean, and to the South Carolina, Tennessee or Virginia line.

SOUTHERN PACIFIC.—The following statement is made of proposed expenditures in Texas, to be made during the year 1902: Widening banks, $67,500; ballasting, $140,800; renewal of rails, $517,592; renewal of fittings, $147,427; renewal of ties, $368,067; new sidings $168,355; new buildings, $287,688; new bridges and culverts, $149,810; fencing, $19,240; interlocking switches, $18,700; locomotives, $715,000; cars, $1,197,000; total, $3,797,159.

Bids are asked for rebuilding 75 miles of the main line of the Central Pacific. The object of the work is to reduce grades and take out curves, and all grades between Wadsworth and Ogden that cannot be removed entirely are to be reduced to a maximum of ½ of 1 per cent. The estimated cost of the work is about $1,500,000.

It is reported that contracts were let, Jan. 1, for work on the south end of the Texas & New Orleans extension of the Southern Pacific, beginning at Mahl, Texas.

SUNSET.—This line in California, extending from Bakersfield, on the Atchison, Topeka & Santa Fe, 28 miles southwest to Sunset, was reported opened for business on Dec. 23. W. G. Nevin, of Los Angeles, is General Manager. (Nov. 8, p. 782.)

TORONTO & HAMILTON ELECTRIC.—Application is being made to the Ontario Legislature by Henry T. Thurber, E. Tisdale and others of Detroit, for a charter of incorporation for an electric line between Hamilton, Burlington, Oakville and Toronto, a total of about 50 miles, paralleling the Grand Trunk.

WABASH.—A ruling was entered, Dec. 18, by Judge Baker, of the Federal Court, at Indianapolis, permitting the Wabash to continue work on its line from a point on the main line in De Kalb County, Ind., to Detroit, Mich., to take the place of the old Eel River Division. A temporary restraining order was asked for by the Baltimore & Ohio but was refused.

GENERAL RAILROAD NEWS.

ATCHISON, TOPEKA & SANTA FE.—The gross earnings for the five months ending Nov. 30, 1901, of the Santa Fe system, were $25.547,304, as against $22,189,987 for the same period last year, an increase of $3,357,316 on increased mileage of 43.91, the mileage this year being 7,850, and last year 7,806. The operating expenses this year for the five months reported showed an increase of $1,126,437 from $13,259,619 to $14,386,057, and the net earnings increased $2.230,879 from last year's figure of $8,930,367. After deducting taxes and rentals, the income from operation for the period recorded this year was $10,318,447, as against $8,113,503 in 1900.

BALLSTON TERMINAL ELECTRIC.—See Railroad Construction column.

BELLINGHAM BAY & BRITISH COLUMBIA.—N. W. Harris & Co., and San Francisco bankers, have bought $500,000 of this company's $1,000,000 first mortgage 5 per cent. sinking fund gold bonds, due in 1932. The road extends between Whatcom and Hardan, Wash., 39 miles, and the entire $1,000,000 capital stock is owned by D. O. Mills, of New York; A. Hayward, B. B. Cornwall, Lloyd Tevis Estate, and J. B. Haggin, of San Francisco, and S. Prentice Smith. Gross earnings during the year ending Sept. 30, 1901, were $109,929, and net earnings over taxes, etc., $45,324. The remaining $500,000 bonds may be issued for extensions at the rate of $15,000 a mile, but only when the net earnings of the road of the preceding year shall have been equal to at least double the interest on all bonds then outstanding, together with those proposed to be issued. An extension of seven miles will probably be built during the coming year from Hardan to coal fields at Cornell's, and further extension in this direction is contemplated.

CHESAPEAKE & WESTERN.—The mortgage recently made to the Bowling Green Trust Co., as trustee, is to provide for $1,435,000 of 50-year 4 per cent. gold bonds. It is secured by a first lien on the extension from Bridgewater to North River Gap, 14 miles, now building by a separate corporation; also by other proposed new mileage and a lien on the road at present operated between Elkton and Bridgewater, 27 miles.

CHESTNUT RIDGE.—Reorganization of this company was completed by the receiver on Dec. 19. The Chestnut Ridge is a line 11 miles long in the west end of Monroe County, Pa., which was sold Nov. 30, and has been reorganized under the name of the Chestnut Ridge Railway. A. M. Palmer was elected President.

DALLAS TERMINAL RY. & UNION DEPOT.—The name of the Dallas, Fort Worth & Gulf has been changed to the above, an amendment to its charter to this effect having been filed at Austin, Texas, on Dec. 16. The company operates six miles of line in the city of Dallas, connecting all the lines centering in the city, and an extension to Fort Worth has been projected. The directors are W. C. Connor, Alexander Sanger, W. O. Connor, J. T. Trexevant, C. A. Keating and E. M. Reardon.

DULUTH TRANSFER.—This property, extending between Duluth and New Duluth, Minn., 12 miles, with a two-mile branch, is to be sold at auction, Jan. 2, by the Special Master in Chancery. No bid under $500,000 will be considered. The company was chartered in 1890 and the road built in 1892. It owns three locomotives and 20 flat cars and has indebtedness to the extent of $1,284,221.

ERIE.—Gross earnings from all lines for the five months ending Nov. 30 were $18,217,372, as against $16,146,042 last year, an increase of $2,071,330. After deducting $12,283,101 working expenses increased from $11,552.612 last year, the net earnings were $5,934,270, an increase of $1,140,840.

INTERNATIONAL & GREAT WESTERN.—Application has been made to the Railroad Commissioners of the State of Texas for authority to issue $280,000 bonds on the new line between College Station, Texas, and a connection with the Atchison, Topeka & Santa Fe at the Navasota River, 18 miles; also to issue $240,000 bonds on 12 miles recently built west from Spring, Texas.

NEW YORK CENTRAL & HUDSON RIVER.—This company has bought, through J. P. Morgan & Co., the entire issue of the income bonds of the Mohawk & Malone, the par value of which is $3,900,000. The bonds are convertible at the option of the company into a guaranteed 4 per cent. second mortgage bond. The Mohawk & Malone, extending between Herkimer and Malone, N. Y., with two short branches, a total of 181 miles, was leased in 1893 and has a capital stock of $4,500,000, and a funded debt of $6,400,000.

NEW YORK, ONTARIO & WESTERN.—The gross earnings of this company for the five months ending Nov. 30 last were $628,690, an increase of $528,690 over the same five months last year. After deducting $1,781,330 expenses and taxes, as against $1,437,886, the resulting balance this year is $847,602, an increase of $185,246, over the figure for 1900.

NEW YORK, SUSQUEHANNA & WESTERN (including the WILKESBARRE & EASTERN).—This company's gross earnings for the five months ending Nov. 30, were $1,248,611, showing the substantial increase of $345,143 over the same period last year, while the working expenses in that time only increased $98,703, or from $546,434 in 1900, to $645,138 in 1901. As a result the net earnings for 1901, $603,473, showed an increase of about 59 per cent. over the net earnings for the same period in 1900, which were $357,033.

NORTHERN PACIFIC.—On Dec. 30, Judge Elliott, of the District Court of Hennetin County, of Minnesota, granted a temporary order restraining the officers of the Northern Pacific from retiring the preferred stock of that company. The order was issued on the application of Peter Power, of New York, a stockholder. Within a few hours the injunction was dissolved by Judge Lochren, in the United States Circuit Court, and the retirement is practically complete.

PITTSBURGH, CINCINNATI, CHICAGO & ST. LOUIS.—The estimated results of operation for 11 months ending Nov. 30, show gross earnings of $18,904,658, an increase of $1,613,222 over the figure for the same 11 months last year. After deducting operating expenses and interest on bonds, rentals, etc., the net profit for 1901 was $1,768,788, an increase of $623,189 from last year.

PORTO RICO ROADS.—On Dec. 16, President Roosevelt sent to the U. S. Senate and House of Representatives an ordinance of the Executive Council of Porto Rico, dated Oct. 28, 1901, and approved by him Nov. 26, granting a franchise to the Compania de los Ferrocarriles de Puerto Rico, a corporation organized under the laws of Spain, to extend its railroad lines to and between certain points in Porto Rico.

RUTLAND.—On Dec. 24 a certificate of consolidation of the Chatham & Lebanon Valley with the Rutland was filed with the Secretary of State in New York, with joint capital of $9,266,000. (Nov. 15, p. 798.)

SOUTHERN MISSOURI & ARKANSAS.—This company gives notice that it has formally taken over the property and franchises of the Hoxie, Pocahontas & Northern, which is a coal road in Arkansas, 15 miles long between the points named. Actual possession began on Dec. 23.

WASHBURN, BAYFIELD & IRON RIVER.—This line, extending between Washburn and Iron River, Wis., a distance of 35 miles, with 30 miles of branches, bringing the total to 65 miles, is to be torn up. Rails and rolling stock have been sold to F. M. Pease & Co., Chicago. The company has for some time been operating with a deficit and has been in the hands of a receiver since 1898. The rolling stock owned at present consists of 30 cars and one locomotive.